

# DISCOVERY

A Monthly Popular Journal of Knowledge

Vol. X. No. 117.

SEPTEMBER, 1929.

PRICE 1s. NET



WIRELESS IN TURKESTAN  
(See page 292)

## CHIEF CONTENTS.

	PAGES
Editorial Notes ... ..	283
New British Forests ... ..	285
Aspects of Handwriting ... ..	288
Wireless in Turkestan ... ..	292
Modern use of the Fultograph... ..	294
Greece of the Far East ... ..	295
Chemistry of the Future ... ..	299
A Race Survey ... ..	302
The Formation of Hail ... ..	305
Education in Labrador ... ..	309
Madeira Food Fishes ... ..	312
The Faraday Centenary ... ..	314
Book Reviews ... ..	315

**Port Vendres** is the door to the East from which sails, twice weekly, steamers along the passage-way of the calm and lovely Mediterranean Ocean to the Winter sunny-room, North Africa—the mysterious and alluring . . .

Further particulars of this route from—PARIS-ORLEANS AND MIDI RAILWAYS, Victoria Station, LONDON, S.W.

## The Manchester Municipal COLLEGE OF TECHNOLOGY

(FACULTY OF TECHNOLOGY IN THE  
UNIVERSITY OF MANCHESTER)

Situated in the centre of a large manufacturing area, the College is able to maintain a close connexion with industry, and thus to afford exceptional opportunities to students contemplating an industrial career.

The Prospectus gives particulars of the courses leading to the Manchester University Degrees (B.Sc.Tech., M.Sc.Tech., and Ph.D.) and Certificates in the Faculty of Technology, in the following departments:—

MECHANICAL ENGINEERING (Prof. Dempster Smith, M.B.E., M.Sc.Tech., M.I.M.E.).

ELECTRICAL ENGINEERING (Prof. Miles Walker, M.A., D.Sc., M.I.E.E.).

MUNICIPAL AND SANITARY ENGINEERING (G. S. Coleman, D.Sc.Eng., A.M.Inst.C.E., A.M.Inst.M. and Cy.E., F.R.San.I.).

APPLIED CHEMISTRY, including General Chemical Technology, Chemistry of Textiles (Bleaching, Dyeing, Printing and Finishing), Paper Manufacture, Metallurgy and Assaying, Chemical Technology of Brewing, Electro-Chemistry, Photography, Colouring Matters, Foodstuffs and Fuels. (Prof. James Kenner, D.Sc., Ph.D., F.R.S.).

TEXTILE TECHNOLOGY (Prof. W. E. Morton, M.Sc.Tech.).

INDUSTRIAL ADMINISTRATION (Post-Graduate Certificate Course) (J. A. Bowie, M.A., D.Litt.).

*Prospectus will be forwarded free on application to the Registrar, College of Technology, Manchester.*

## Bedford College for Women

(UNIVERSITY OF LONDON)

REGENT'S PARK, NW 1

*For Resident and  
Day Students*

Principal - Miss M. J. TUKE, M.A.

*Degree Courses in Arts and Science  
Course of Training in Social Work*

SESSION 1929-1930 begins Thursday, October 10th  
Prospectus free on application to the Registrar.

OLIVE E. MONKHOUSE, Secretary.

## University of London

*The University Observatory at  
Mill Hill will be opened on  
8th October, 1929.*



*Students will be admitted for the  
purposes of Research and post-  
graduate Studies in Astronomy.*

FOR FURTHER PARTICULARS APPLY TO THE UNDERSIGNED:

C. O. G. DOUIE, Secretary,  
University College, London (Gower Street, W.C.1)

*Second Edition.*

## COLUMBUS— UNDERGRADUATE

By John A. Benn  
Editor of *Discovery*.

The author "followed the unusual and enterprising course of taking a year at Princeton before going up to Cambridge."—*Manchester Guardian*.

"If any English schoolboy or his father is contemplating a repetition of this experiment, he cannot do better than read this book."—*Evening Standard*.

"This is a very original and highly interesting little book; it might indeed almost be said to be unique."—*Daily Telegraph*.

"We recommend the book as giving a clear and critical impression of what life in an American University is really like."—*The Spectator*.

Six Shillings Net.

London: ERNEST BENN LTD



# DISCOVERY

A Monthly Popular Journal of Knowledge

Vol. X. No. 117. SEPTEMBER, 1929.

PRICE 1s. NET

Trustees: SIR J. J. THOMSON, O.M., F.R.S., SIR F. G. KENYON, K.C.B., F.B.A., PROFESSOR A. C. SEWARD, Sc.D., F.R.S., PROFESSOR R. S. CONWAY, Litt.D., F.B.A.

Edited by JOHN A. BENN.

Publishers: BENN BROTHERS, LTD. All communications respecting editorial matters to be addressed to the Editor; all questions of advertisements and subscriptions to the Manager.

Offices: Bouverie House, Fleet Street, London, E.C.4. (Closed on Saturdays.)

Telephone: City 0244 (10 lines).

Telegrams: Benbrolish Fleet.

Annual Subscription, 12s. 6d. post free anywhere in the world. Single numbers, 1s. net; single back numbers more than two years old, 1s. 6d. net; postage 2d.

Binding cases, price 2s. 6d. net each; postage 6d. Complete bound volumes, 17s. 6d. net each; postage 1s.

## Editorial Notes.

REGULAR readers will have noticed the large amount of space devoted in these columns to research in Canada. The fact is that this great Dominion is at present the centre of more scientific activity than probably any other part of the British Empire, for not only are new sources of raw material and mineral being discovered, but extensive surveys are being made. Large new tracks of land are also undergoing settlement and in the north new railways are under construction. We therefore read with interest that steps are being taken by the London County Council to provide more up-to-date information in the text books used in their schools. Serious complaint was recently made by a Dominion visitor who questioned the pupils, from which it appeared that much of the matter in print about this particular country was many years out of date, and that those receiving instruction from these text books were securing a very inadequate impression of its development. In the experience of the High Commissioner in London, many books about Canada are based on others now out of date, the author merely inserting new facts and figures as they become available to him. This process of correction, however, is unsatisfactory, and entirely new books are required every few years, in view of the many discoveries. During the present century, Canada has evolved from a country mainly devoted to rural pursuits to one engaged to a greater extent in manufactures and in overseas trade. Moreover, the Dominion has expanded its national

consciousness and attained an importance in world affairs not claimed when many of the present text books were written. Schoolmasters are reminded that the office of the High Commissioner in Trafalgar Square has a complete reference library where every possible assistance in selecting suitable books or information is obtainable.

\* \* \* \* \*

A literary discovery of the first importance will be introduced to the public next year under the title "Advice to a Son," written by the ninth Earl of Northumberland, and edited with an introduction by Dr. G. B. Harrison. An old note assigned the manuscript, which is dated 1595 and 1609, to Viscount Conway, but it now proves to be by that much more famous person the "Wizard Earl," a brother-in-law of the Earl of Essex (Lytton Strachey's Essex) and lord of many lands in the north, west and south. He was imprisoned in the Tower by James I at the same time as his friend Raleigh, and there wrote the bulk of his "Advice." The first part, dated 1595, is written in good Elizabethan prose, and deals largely with education. The second part, dated 1609, is more "racy," describing the management of great estates, of servants, and above all of a wife. It becomes clear that the sister of Essex had been a sore trial to the worthy Earl! A small part of the manuscript was printed in the journal of a learned society ninety years ago, but for all intents and purposes the whole is now to be published for the first time. Dr. Harrison's introduction deals admirably with Northumberland's career, with the Raleigh circle, and with the various examples of similar books, such as Lord Chesterfield's "Advice to a Son," which have been written before and since.

\* \* \* \* \*

We await with interest the issue of further particulars about a new material known as Brotex, and as little comment has yet appeared in the Press, we make no apology for reproducing here some particulars from the prospectus issued last spring by Brotex Cellulose Fibres Limited. Brotex is an agricultural plant which grows regularly from seed,

\*

and matures rapidly within twelve to eighteen months, attaining a height of up to ten feet, with a stem circumference of about ten inches. If planted out in the spring, and harvested in the late summer of the following year, it is said to produce three raw materials of commercial value, namely, fibre for textile purposes, wood cellulose from the core of the plant for paper making, and seed for cattle food. As many as 7,000 plants to an acre can be grown in this way; alternately, if planted in the spring and harvested in the same year for its fibre only, 40,000 plants per acre can be grown. According to the company's technical adviser, Mr. Atkinson Adam, a total yield of nine tons of material per acre may be expected from a mature crop, of which the value at the lowest marketed price is said to approach £100. The cost of growth, cultivation and harvesting is estimated to be less than half this amount; and the plant is suitable for cultivation in the south of England and other parts of the British Isles. The company at present maintains its own farm for experimental and seed producing purposes, and judging from the published reports about Brotex of certain independent companies engaged in the use of fibre, the new material would seem to have a highly interesting future before it.

\* \* \* \* \*

In conducting these columns it is always refreshing to be reminded of their aim, and a few days ago we came upon some suggestive comments written around the word "discovery." What, the anonymous writer asked, does this wonderful word not suggest? A thousand possibilities about the future, and all different, or possibly something well-worn about Columbus or Newton or James Watt. If one were elected to discover something new, what would it be? What new discovery would most benefit mankind? These are interesting speculations. There is so much of the past in this word, and so much of the future—so much of man's effort—hence its imaginative appeal, its infinite suggestion. Romance and actuality meet and blend in it. We think of Livingstone or of Robinson Crusoe, or put down Hakluyt to pick up Shackleton, or pass out of the old-fashioned seminary of Jules Verne into that modern university called H. G. Wells—there to run back to the Stone Age or forward to some Utopia of science. We are under the spell of discovery all the time, and share something of the agitations and triumphs of the discoverer. Or may be we are practical-minded, and the discoveries that interest us turn on such things as borings for oil, the rubber maker or a new invention. The housewife connects the word with the latest kitchen labour-saving device; the teacher thinks of Madame

Montessori; the physicist tries to make the Einstein theory clear to himself or to us; the chemist bends over his tubes in search for the new dye. The politician and economist would fain be discoverers too—some new theory, some new system. The psychologist is also active in the region of discovery; he looks into our minds and applying his deductions to the factory calls them "scientific management." And, lastly, the historian may equally claim his place, in finding out about the past and handing on its experience for the benefit of the future.

\* \* \* \* \*

Recent researches conducted by two prominent Swedish archaeologists, Professor Birger Nerman and Dr. Ture Arne, reveal that the Swedish Viking expeditions were not merely private ventures, but were organized by the Swedish State with the object of founding colonies on the opposite coast of the Baltic. Evidence for this theory is found from the Viking remains which are found practically everywhere in the soil of Russia and of the Baltic States, as well as on old documents, such as Nestor's Russian Chronicle, the Hamburg Bishop Rimbart's chapters on Sweden, and the Icelandic historian Snorre Sturlason's exhaustive volumes. The reason why the Swedes left their home country and waged uncertain wars in far away countries is said to be the over population, as well as the inspiring example of the originally Swedish Goths and Heruleans some centuries earlier. To the Swedish traders of this epoch the access to the Mahometan and Byzantine markets was very important, and in this connexion their kings conquered the mouths of the mighty Russian rivers and finally large stretches of the country itself. This amazing proof of early foreign diplomacy of the Swedish State is corroborated by the fact that King Bjoern of Sweden about 825 sent a deputation from Sweden *via* Russia and Constantinople to France, where the Swedish delegates presented their gifts to King Louis the Pious and asked him to become an ally against the Danes. That Mahometan diplomatists, coming from the Turkestan rulers as well as from the Moorist State in Spain, visited Scandinavia in the tenth century is known from manuscripts found in Arabian libraries, and this early diplomatic intercourse is another proof of the far sighted policy of the Swedish Viking kings.

\* \* \* \* \*

In our recent report of the tests made at Loch Long of certain new diving devices, it was erroneously stated that the air exhaled into the apparatus was regenerated by the absorption of carbon monoxide. The latter should, of course, have been carbon dioxide, as the monoxide rarely, if ever, occurs in human breath.

F  
ad  
m

PRIOR  
policy  
middl  
had  
consu  
treble  
tenth  
were  
price  
had b  
Durin  
woods  
utmos  
being  
spite  
shipp  
to br  
count  
for  
Deper  
timbe  
handi  
nation  
timbe  
safety  
as in  
A  
chair  
to co  
conser  
resour  
exper  
that a  
the sy  
soon  
settin  
acqui  
for co  
adjud  
with  
The  
mend  
conne



## More Forests for Great Britain.

By A. G. Herbert, M.A.

*For ten years past the British Government has undertaken afforestation on a national scale. With 140,000 acres already planted, a good start has been made in a scheme which is designed eventually to cover more than a million acres. Special nurseries are in operation to provide the many transplants required.*

PRIOR to the Great War the need for a national forest policy in Britain had become evident. Since the middle of the nineteenth century timber imports had quintupled, and consumption per head had trebled. In 1914 only a tenth of our timber supplies were home grown, and the price of imported timber had been rising for years. During the war the home woods were exploited to the utmost, over 400,000 acres being clear felled, but in spite of that fact as much shipping was necessary to bring timber to this country as was required for grain imports. Dependence on imported timber proved a serious handicap in the period of national emergency, and it became obvious that more timber should be grown in the interest of national safety; national forest policy was as inevitable here as in other European countries.

A committee was appointed in 1916 under the chairmanship of Sir (then Mr.) Francis Dyke Acland, to consider and report upon the best means of conserving and developing the woodland and forestry resources of this country, having regard to the experience gained during the war. As it was obvious that any State afforestation scheme would depend on the systematic acquisition of land, this committee very soon issued an Interim Report recommending the setting up of a special body to enquire into land acquisition problems and making certain suggestions for consideration, both with regard to the body to adjudicate in cases of compulsory acquisition and with regard to procedure.

The Leslie Scott Committee in turn made recommendations for the simplification of the procedure in connexion with the acquisition of land for public

purposes, but the only suggestions adopted by Parliament were those subsequently embodied in the Acquisition of Land Act, 1919, which amended the law as to the assessment of compensation in respect of land acquired compulsorily for public purposes. It is to be hoped that Parliament will find time to deal with the other recommendations.

Having transferred the land question to an *ad hoc* body, the Acland Committee proceeded to consider the condition of British woodlands and to prepare a definite scheme of State afforestation and State assistance for private forestry enterprise. The total area under woodland

had before the war been estimated at 3,000,000 acres. The committee realized that the annual yield had been inadequate, but at that time the extent of the effect on our timber resources of the subsequent heavy fellings during the later years of the war could not be foreseen.

The committee's scheme, hereafter referred to, was based on the assumption that the 3,000,000 acres would be maintained in a productive state. The recent Report on the Census of Woodlands states, however, that it is unlikely that the area of effectively productive woodland in private ownership will in future exceed 1,500,000 acres, and that any acreage over this figure which is deemed necessary for the welfare of the country will have to be planted by the State. It will be appreciated, therefore, that the position is far more unsatisfactory than the Acland Committee anticipated when they prepared their programme.

Further, they pointed out that we derive more than half our imported timber from virgin forests



PROTECTING THE SEED BEDS.  
The method used at Halwill Nursery is here illustrated, the seed beds being covered with spruce branches and so protected from the weather.

in foreign countries, which are steadily being depleted, and that unless arrangements could be made for the conservation of the Canadian timber reserves, the only large reserves within the Empire, provision should be made within Great Britain on a far larger scale than they then proceeded to propose. They considered it necessary, while making due allowance for an improved yield from existing woods, to afforest 1,770,000 acres in eighty years, two-thirds of the total to be planted in the first forty years. There was ample afforestable land for such a scheme without encroaching on agricultural land. The land required would be waste land, put to little economic use.

#### The Initial Scheme.

As an instalment it was advised that in the first decennium conifers should be planted on 150,000 acres by the State and on 50,000 acres with State assistance by local authorities and private individuals, who were expected during the period to replant 50,000 acres, making a total of 250,000 acres of soft woods. In addition, they suggested the replanting of 10,000 acres of hard woods in the initial period. The State programme of 150,000 acres was to be on an expanding basis, starting in the second year with 3,300 acres and increasing annually by about that area, so that the programme for the tenth year would be 30,000 acres.

The committee recommended the establishment of a single Forest Authority equipped with the necessary funds and powers. To finance the work for the first decennium they estimated that approximately £3,500,000 would be required. This was to cover all operations, such as acquisition of plantable land in areas of sufficient size to be worked economically and to provide continuous yield and employment, the acquisition of nursery ground and the rearing of the plants, preparation of the forest area, draining, fencing, planting, weeding, and beating-up; the estimate also covered afforestation grants to local authorities and others, and expenditure on forestry education, research, experiments, and so on.

The Report of the Acland Committee was not shelved like so many previous reports, but resulted within a year after the war in the passing of the Forestry Act of 1919 which set up H.M. Forestry Commission to promote afforestation and the production and supply of timber in this country. The act empowered them to purchase or lease land for planting or for purposes in connexion with afforestation, to acquire land compulsorily, to erect buildings, to make grants, to assist or advise regarding the management of private woods, and generally

to promote the interests of forestry at home. It was provided that expenditure would be met from a Forestry Fund into which would be paid £3,500,000 for the decennium beginning the 1st April, 1919, and also the Commission's receipts from sales of timber, etc. Those who outlined and drafted the terms of the British Forestry Act of 1919 may be flattered by the fact that the Japanese Forestry Act of the following year is based on its British predecessor.

The Commissioners were appointed under the chairmanship of Lord Lovat in November, 1919. Their task was not easy. State forestry was a new departure in this country. There were no virgin forests and no State forests except the small area of Crown Woods which had been depleted during the war. No Forestry Service existed and the executive, administrative and supervisory staff had to be found. A nucleus staff was built up from men who had studied and taught forestry at the universities and agricultural colleges, from the small forestry branch of the Office of Woods, now the Office of Crown Lands, from ex-Indian Forest Service men and from men with experience in Canada or on the Continent or on private estates in this country.

With normal seed years it takes three years on the average to raise plants suitable for planting out in the forest, but during the war tree seed had been purchased and nurseries had been established, in anticipation, with the result that a stock of plants was available for planting out in the Commission's first season.

#### Difficulties Surmounted.

The afforestable land in the country had not been surveyed, and surveys had to be done at the same time that land was being acquired, planting proceeding simultaneously. But perhaps the main difficulty was the fact that the value of the pound sterling has been very different during the last ten years to what it had been when the Acland Committee made their estimate. Other difficulties arose during the period. The expanding planting programme was proceeding without hitch when the Geddes' Committee intervened, with the result that the planting programme remained stationary for three seasons, although expansion was thereafter resumed.

In 1924 it was decided that a scheme of land settlement in connexion with State afforestation should be undertaken by the Commission on lines indicated by the Acland Committee. As a result the Commission have shouldered the burden of considerable additional expenditure without the additional funds required for this special purpose.

The Commissioners were not appointed until eight months after the start of the decennium, but now that it has ended let us see what they have made of their stewardship. They have acquired by purchase, long lease or feu 465,000 acres of land of which 298,000 were, at the time of acquisition, classified as "plantable." In addition there were transferred to them in 1924 Crown Woodlands comprising about 120,000 acres, of which some 60,000 are carrying timber or are under forestal treatment. They have planted close on 140,000 acres, including 7,000 acres of hard woods. The planting therefore has not fallen far short of the ten year instalment suggested by the Acland Committee, and the shortage may be attributed to the Geddes' check above referred to. Mention should, however, be made of the unprecedented loss by fire this year of some 5,000 acres of plantations, due to the abnormally dry winter and spring.

In their nurseries, which now extend to 850 acres, carrying enormous stocks of seedlings and transplants, and in their forests, the number of foresters, foremen and forest workers ranges from a minimum of 2,700 in the summer to a maximum of 3,600 in the winter. The technical staff number fifty and the clerical and accounting staff are less than one hundred. They have paid to local authorities and private owners grants ranging from £2 to £4 per acre in respect of the preparation and planting of 70,000 acres, and in addition scrub-clearing grants from £1 to £2 per acre in respect of 10,000 acres.

It was not until the summer of 1924 that the Commission were authorized to proceed with a scheme for the provision of forest workers' holdings on the basis of not more than five holdings to 1,000 acres of plantable land. The holdings, which are limited to



FIVE YEARS' GROWTH.

Typical area planted in 1923-4 with Douglas Fir, the trees having already attained a height of from nine to twelve feet.

ten acres, are equipped with houses and outbuildings. The majority of the holdings are for poultry and pigs but, where there is an outrun, sheep stocks are held; there are a few arable holdings and some orchards. The tenants are guaranteed not less than 150 days' work in the forest annually, but, in fact, their employment in the forest is generally whole time. The scheme is an effective and inexpensive method of rural settlement, at present on a small scale. Of these holdings nearly 600 have been completed and 250 more are under construction. In addition, some bare land holdings are let to tenants who were already housed.

The Commission have made grants annually amounting to £4,200 towards the expenses of higher forestry education at certain universities and colleges. They established and maintain two schools for a free two-year course for forest apprentices with a view to their subsequent appointment as foresters. They are carrying out an extensive programme of silvicultural research and experiment, in addition to making grants to certain universities for research work. They have published eleven bulletins and twenty-two leaflets, giving the results of investigations they have made on some of the more important forestry problems, while advice on matters relating to forestry is given almost daily. Forestry exhibits are provided at the leading agricultural shows. They have conducted a census of the woodlands of Great Britain and a census of production of home-grown timber. The Report published last year states for each county the acreage of high forest (subdivided into five age classes) and of coppice, coppice with standards, scrub and felled or devastated areas.

The Commission initiated the Imperial Forestry Conferences, the first of which was held in this country



A LARCH PLANTATION.

Some of the Japanese Larch here seen have grown thirteen feet high. Planting was carried out six years ago on bare moorland.

in 1920, the second in Canada in 1923, and the third in Australia and New Zealand last year.

But these activities are subsidiary to the main work of afforestation. The State planting has proceeded at 124 centres in many parts of the country from Cornwall to Sutherlandshire, from Carnarvon to East Anglia, where is situated the largest of the State forest areas. Of conifers the species planted have been Scots and Corsican pines approximately 50 per cent, Norway and Sitka spruces 25 per cent, European and Japanese larches 12½ per cent, and Douglas fir the same.

The State afforestation scheme should before the expiration of the first rotation of eighty years be self-supporting. Although the Commission's marketing activities are at present relatively small, their receipts already exceed £100,000 annually. But forests are a national necessity, and their financial results are not the only results of national value. The forests minimize dependence on imported timber in times of national emergency; in our case 90 per cent of such imports come from foreign countries. National forests will also minimize the effect of probable stringency in supplies from other countries. National afforestation is also justified by the great social benefits which

result, providing as it does healthy permanent rural employment in districts where the land is waste or unsuitable for economic agricultural development.

What are the proposals for the immediate future? For the second decennium now starting a State planting programme of 225,000 acres is proposed. The financial provision is stated to be £5,500,000 which, with receipts of something over £1,000,000, will enable the Commission to provide the new plantations, to maintain those already existing, to provide grants for forestry education and research, and for the planting of municipal and private land, and to devote £1,000,000 to forest workers' holdings. In view of the fact that, if we continue during the second decennium to import timber and wood pulp into this country at the same rate as last year, we shall pay £500,000,000 for such imports, the proposed planting programme for the second period appears to be small.

The Acland Committee's proposals included afforesting 1,180,000 acres with conifers in the first forty years. With the present programme no more than 365,000 acres will be planted in the first half of that period, leaving 815,000 acres to be planted in the last half.

## New Aspects of Handwriting.

By Robert Saudek.

Author of "The Psychology of Handwriting."

*The study of handwriting by photography and other experiments reveals that former ideas on the subject are out of date. "Character" is only one of several factors associated with manuscript, from which, among other things, the expert can now discover how its author set to work.*

FOR many years people exercised their minds as to whether graphology was an art based on exceptional gifts or inspiration, or a science—or might become a science—to be tested and proved with objective and exact methods of establishing psychological facts. Graphology at first was certainly not scientific, and it only became so when the peculiarities of handwriting were methodically investigated. It had to be established whether, in fact, the total of all those properties which we designate in familiar language by the word "character" alone determined the formation of handwriting, or if other quite different factors should be taken into consideration. In the earlier, more dilettanté treatment of the subject, the latter point was entirely ignored.

As the result of new research, we know to-day that the slogan "handwriting and character" is misleading. Handwriting and character in various

circumstances are in no way interchangeable or inter-dependent; character is only one of the factors which influence our handwriting. The advance made by graphological study now enables us to recognize twelve different factors. We are able by organized experiment and investigation to demonstrate these twelve factors, or in more scientific language, to isolate them. Of these twelve factors character is one, and one only. As it frequently happens that we still meet with writing which does not fully reveal the character of its author, we must believe that there are further factors in addition to the twelve known. We have, however, come so far that in about 98 per cent of all cases we can not merely declare, but really prove, that the character of the writer is revealed in his handwriting, and we are able to substantiate this by scientific methods. When we have to tackle a particular exception with which our present knowledge



is insufficient to cope, it is well to acknowledge it, and therefore protect ourselves against false premises. A competent experimental graphologist should not nowadays make false diagnoses. He must not pretend to know everything, and when he perceives that his judgment based on the handwriting cannot be absolutely definite, he should not only admit the fact, but emphasize it. In most sciences there are similarly still unsolved problems, and no discredit is brought by recognizing limitations.

There could be no scientific graphology so long as it was imagined that handwriting and character were in definite relationship. It is true that in the psychological sense any handwriting is a brainscript. Unwittingly we publish our personality in our writing and it does not matter whether we use the left or right hand, the left or right foot, or the mouth. The supposition is that whichever part of the body we use to make the movements of writing, it functions so normally that the impulses sent out from the brain are followed. If a man loses his right hand and begins as an adult, to write with his left hand; or if he loses both hands (as did thousands of soldiers in the Great War) and then writes with the foot, holding the pen between the toes; or if he loses all four limbs and then learns to write with the mouth, holding the pen between his teeth and making the necessary movements by the action of his tongue on the end of a short penholder; he will always develop his own, and according to his personality, typical style of handwriting.

#### Effective Influences.

While it is established that the central nerve system adjusts itself in this way to every new situation, and also that the form or size of the part of the body so utilized has no influence on the form or size of the writing, the fact remains that bodily changes or transmitted restraints may so importantly influence the writing that we are scarcely able to recognize otherwise well-known features. One of the eleven other mentioned factors is the state of the member (hand, foot or mouth) at the moment of writing. If there is a sprain or strain so that the corresponding muscle system does not function, then naturally the fluency of the writing movement is interrupted. The result is broken or trembling forms, the writer is not able to direct the pen in the desired direction or to bring it to a stop in the right place, and grotesque, distorted features result—distinct clues written on the paper.

To the many new methods of research effective in revealing the course of writing must be added the



Signature of the forty-six-year-old German author, Oscar Baum, who became blind at eleven years of age. As he has not been able since to receive visual impressions he writes like an eleven-year old child though he is an intellectual man of ripe age.

time-magnifying photography of hand movements. It was first applied by Frank Freeman at the University of Chicago, who obtained twenty-five exposures of one-thousandth of a second. When these exposures are enlarged and placed one over the other, the difference between the first and second, the second and the third, and so on, can be recognized, that is, the change which takes place in the writing during a period of almost exactly a quarter of a second. In this way ten laws of writing movements have been discovered, which were entirely unknown to the graphologist of the old school. For instance, it was found that at the beginning of a word the first and second photographs reveal no difference, indeed are identical. This shows that no one is able to start his writing movements definitely at once, but actually needs a fraction of a second before his pen-nib acts correctly on the paper. This is called "beginning adjustment." Even the fastest, determined and spontaneously acting person needs at least two twenty-fifths of a second for this adjustment. Slow, ceremonious, heavy persons, who are conservative in their manner of living, do not get correctly into action on paper in this period, but need six, ten, and even twenty-five times the unit before their writing capability begins. In this simple graphical sign one can therefore read straight away the degree of spontaneity or the formality of the writer. Moreover, it can be shown from many simple examples that the graphological consequences are not based on chance observations, for a brief text will contain hundreds of specimens of "beginning adjustment," and always of a new kind coupled with different letter combinations. It can hardly be claimed that the same phenomenon manifesting itself a hundred times does not actually characterize the writer.

In the same way there is the "ending adjustment," that is, a pause while the pen halts at the conclusion of a word unit before it is lifted clear of the paper to move slightly forward for the commencement of a new word. Again we find a hundred different examples which clearly show whether a man attacks his work quickly and with determination, or, on the contrary, pauses after the slightest task in order to regard carefully the result of his effort, to rest, or to breathe freely till it pleases him to continue.

the pleasure of acting  
under you  
I am  
My dear Sir  
Sincerely Yours  
Charles Dickens

he made the wise remark to a young  
gentleman he got up (on  
the 1st of Oct) at Verona?  
Ever affectionately  
CD

Normal handwriting of Charles Dickens and writing a few hours before his death. From the handwriting we can see how far the bodily weakness and how far spiritual depression and bitterness against the physical condition are responsible for the second specimen.

It is generally agreed that the writing material (pen, ink, paper, pencil) used plays a part in writing, according to its good or poor quality, or its common or uncommon form. One who is accustomed to write with a pointed nib would not recognize his own writing when circumstances compelled him to employ a soft broad nib. Involuntarily he retouches his script and corrects unusual forms, till he reconstructs his natural writing-picture. In this connexion it is noticed by investigators that one particular retouching of an alphabetical form stands out distinctly from six other retouchings. The six are harmless, but the one is found to be one of ten signs denoting dishonesty.

A further factor in analysis is the school style on which the learning of writing is based. Naturally only those who have neither forgotten nor learnt anything since school age still write in the manner of their early days. Nevertheless, be the deviation from the school style ever so wide, the early forms flow unwittingly from everyone, because in childhood these forms have sunk deep and anchored in each person's consciousness. For example, a sample of writing executed by Herr Masaryk, the present President of Czechoslovakia, shows the combination of the two characters *s-t* in a shape unknown in any other school-copy but German. Dr. Masaryk was seventy when he wrote the particular lines, but the

fact that as a boy he first learned the German script, and only later the Roman, can be conclusively demonstrated in his present writing. An expert can easily find out at least the general style of the school-copy from which a writer has learnt in childhood, provided he is supplied with a text, of say, fifteen lines of a "natural" writing.

The old graphologist believed that vertical or backward slanting writing denoted reserve and cold-bloodedness, while forward sloping writing revealed a peaceful, trustworthy, sociable being. The senselessness of such a theory will be clear when one considers that the youngest generation is once more being taught upright script, and that until the seventeenth century vertical writing was common all over Europe. It would be inconsistency if a graphologist ignored the school preparation or the style of a period, especially since it was formerly declared that disconnected writing—in which the letters are not connected one with the other—was a sign of an "intuitive" nature, which grasps an idea promptly and understands what others of a deductive nature would arrive at only by systematic and logical processes of thought. Until the fifteenth century all writing was disconnected! In order to rescue this ridiculous theory it must, therefore, be accepted that Europe up to this time was inhabited by intuitive people only, or that in consequence of a natural law, not yet discovered, all deductive personalities were alphabetic and that all with the ability to write were *ipso facto* intuitive. However, a man who writes with a rusty pen nib and thick congealing ink cannot make fine hair lines, and realizing this, he ignores them, making only the heavy strokes in printing form on the paper. To the old graphologist only the fact that he had written disconnected would appeal and as a result the writer would be classified as intuitive. The next day the same writer might use a good pen nib suitable to his style, and in consequence would wander over into the deductive class.

### Time-Magnifying Photography.

Thanks to the time-magnifying photograph, we now know which part in each finger, each muscle and joint, is employed in the act of writing. Strong strokes are created by concentrated action of the muscles, and hair strokes by extensor expansion movement. It is common to everyone that the contractor muscles function much stronger than the extensor, and so when the latter are particularly weak that person will write with disconnected letters, not because he is "intuitive" but because his individual muscle system is adapted to this particular style of writing.

Other most important factors are the visual impression capability of the individual, his visual memory and his manual skilfulness. Where these three properties are strongly represented they will altogether influence the handwriting in such a way that the characters are perfectly revealed. A university servant can develop a refined and erudite handwriting, since throughout his life he cleans the blackboard on which the professors have studiously endeavoured to formulate such a style, and because unconsciously he follows their style of writing, even though it does not conform to his own standard of learning and psychology. A case came under my observation in which the female private secretary of a Government Minister, after she had served him for two years, patterned her own natural (and quite different) writing so closely on his that their calligraphy could not be distinguished. The character of the one or the other had not changed, but the secretary's capacity of visual impression, visual memory and manual adaptability, coupled with her admiration for her chief, brought about this result.

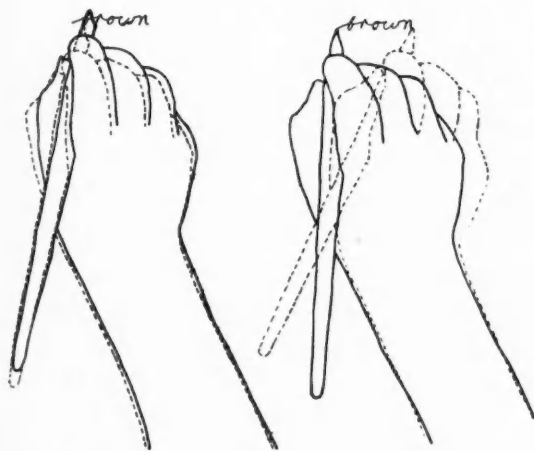
It is only blinded persons who never change their letter forms, whether their characters alter or not. This is because they are now not able to receive further visual impressions, and write only with the memory of their own earlier style developed with unconscious reflex movement before the onset of blindness. On the other hand it is natural, for example, that the writing of an impressionable Italian with a good memory for form should be affected, during a ten years' residence in England, by the national character of English handwriting; and I have never

*Dear Mr. Saudet  
Please find herewith a few  
lines written by holding the pen  
between my teeth as requested. I am  
very sorry to say that all lines that  
was written with my right hand has  
been destroyed long ago, trusting that  
this will be of some use to you  
I Remain  
Yours truly*

Mouth writing of a limbless soldier: still uncertain in movement. (Transition period.)

known a case of a German whose handwriting did not absorb American elements after several years' residence in the United States. However, we can neither refine nor disguise in some other way our natural writing, without paying for this performance by impairing the spontaneity of the actual wording of our manuscript. When a beautifully shaped script has been produced spontaneously and at a rapid pace, these two facts are clearly revealed by the various features of the writing and prove conclusively that the writer had his wording perfectly in mind before he put pen to paper. The difference between a careful and a "natural" script of the same writer is sometimes almost incredible. Further, those who write a strikingly pleasant hand when minding their calligraphy, often allow themselves to scribble unpardonably when penning down their "first drafts."

If a person who is (in our terminology) a "mature" writer wishes consciously to modify his handwriting he can do so only by imitating alien models. Only in very rare cases is this done by the actual delineation of the model before his eyes; in most cases he imitates it from memory, although persuading himself that he is not reproducing forms from memory, but is inventing the new forms. There is, however, nothing in the memory that has not previously entered by way of the senses, and the man who really creates new forms is not born every year. Although we may consciously or half-consciously or unconsciously imitate alien forms, we are bound to have seen them somewhere, at some time, with our eyes. In the course of years our handwriting does not change exclusively in proportion as our character changes; the change is due in part to other influences, and among these to the visual impressions received year by year. This is why blinded people alone do not alter the shape of their letters as they grow older.



Different hand positions in writing the word "brown." Left.—Beginning and ending of an upstroke. Right.—Beginning and ending of writing the word.

## Wireless Reigns in Turkestan.

By Louise Strong, Ph.D.

*The Russian Government is making full use of wireless in administering its Central Asiatic territory, and especially remarkable are the developments in Turkestan during the past two years. The principal broadcasting station is at Tashkent, which the writer visited. Ancient native music is now being investigated.*

ANYWHERE in the world wireless still retains its glamour, but nowhere does it seem quite so much like magic as in ancient Turkestan in the heart of Asia, one of the earliest homes of settled humanity, across whose irrigated lands swept once the hordes of Ghenghiz Khan and Tamurlane and even earlier the Macedonian Alexander. Here among a native population still over ninety per cent illiterate—whose women are to-day being murdered by angry husbands for discarding their veils, and where the fight against polygamy and child marriage is an event of the past five years—wireless seems indeed like the return of their own Arabian Nights.

During a visit to Tashkent I noticed a lively little motor-car, bearing a loud speaker, which darted hither and thither among the crowds and put on programmes at street corners, for the purpose of advertising wireless and inducing people to buy receiving sets. The contrast between this highly efficient modern form of "band-waggon," and the crowds in turbans and flapping robes which surrounded it, led me to visit the broadcasting station and talk with its manager. Schneider is his unromantic name; he is a former resident of Tashkent who fled during the chaos that followed the revolution. In Paris he worked for several years with a wireless company learning the business; then when life became normal again in

Turkestan, he returned to his native city as manager for the new station. Mr. Schneider told me that wireless has grown very rapidly in Soviet Central Asia. Two and a half years ago, there were only five receivers listed in the Tashkent district, and these had been bought by workers' clubs to listen to concerts from far-away Moscow. Then the Tashkent broadcasting station was established, with later others at Samarkand and Ashkhabad, and receivers spread rapidly, especially when programmes were introduced in all the native languages—Uzbek, Tadjik and Kirghiz—besides in Russian.

At the outset the invention was received slowly; it was a great shock to the countryside. In backward villages, where hardly a soul can read, it was thought nothing less than the devil. When you told the people they were hearing Tashkent, they at first disbelieved you; they thought it was a trick, something going on in the next room. But when they were convinced by concerts which could not have been given in their village, then they were frightened by the black magic. Gradually, however, they became interested, and when they had grown used to its novelty, the wireless went with a rush. To-day you may be travelling a hundred kilometres or more from the railway and suddenly see an aerial. You think it belongs to a Russian who has installed radio to comfort his homesick isolation, but



EUROPE CALLING!

In addition to hearing programmes in their own languages, the natives in Turkestan are learning to listen to European stations. But they have a strong dislike for our "Western" music.



it is more likely in the village club of the Uzbeks, or perhaps the nomad *yurt* of the Kirghiz. Even far away among the Pamirs, the "roof of the world" which lies between China, Russia and India, there are wireless sets. In these distant places they are seldom owned by individuals, for no one knows how to instal them, and the expense of sending our experts so far from the railway is more than an individual can pay. Radios are therefore installed chiefly in village clubs and libraries, or in the little new theatres where the travelling cinema is displayed.

The Tashkent station is not commercial and takes no advertisements. It is supported by the Russian Department of Posts and Telegraphs, which pays all technical expenses, and by the Department of Education which pays for the artists. The programmes are therefore educational, but not heavily so, being largely governed by the requests of the listeners who write very freely to the director of the station. The usual evening programme, for instance, begins at six o'clock with the "calendar" in the Uzbek language, transmitting the date, the hour, the weather and recent news. It must be realized that these announcements go to villages which cannot be reached by newspapers for many days or even weeks. In the Pamir villages no newspapers will arrive till the following spring opens the frozen mountain passes; but the wireless now keeps the people informed of the news. It also reaches places which have no clocks or only unreliable ones, and has thus introduced "time" to Central Asia. The programme continues with perhaps a simple talk on "Travels in the Soviet Republic," to acquaint the listeners with the geography of their own country. Then there is a half-hour concert of Uzbek music, the wailing tones of the strings sounding very monotonous to European ears but dearly loved by the native population. After this comes a repetition

of the radio calendar in the Kirghiz language, and then another concert by artists from the Caucasus. On other evenings there may be a talk on "Economic

Development of Central Asia," or on history, physics or chemistry. Most of the population know nothing of modern science and are very eager for knowledge. The Russian Department of Education considers the wireless a very important channel of instruction.

The native peasantry begins to go to bed at eight o'clock in the distant villages, and the hour arrives for the Russian programme. Russians have more lamps than the natives and therefore keep later hours. Their programme is similar, except that it is supplemented by lessons in the Uzbek language, a subject now very necessary for those Russians who wish to make their careers in the new national republics of Central Asia. Scattered



UZBEK WIRELESS ORCHESTRA.

Typical native orchestra, using the strange stringed instruments of special technique. Uzbek music cannot at present be written on any system of notation known to Europeans.

across Central Asia are lonely groups of Russians, peasant colonists, workers on the railways and on the big farms of the Cotton Trust and in its scientific stations, frontier officials on the borders of Afghanistan and China, engineering staffs and labourers, and to all these pioneers the wireless provides a unique link with central authority.

"The wireless station is like a big father to the people," Mr. Schneider said. "Often we are their only connexion with the central cities and government. When I first came here from France I found it lonely, for one grows used to the culture of Paris and misses it in Central Asia. But now my work interests me more than it ever did in France. There we were just an ordinary commercial station, here we get friendly letters, appeals and thanks, and are in touch with the intimate life of the people." He showed me several letters. A young radio amateur writes from a distant village: "Is it permitted under Soviet law for a man to have two wives? Yet the president of

our village Soviet has recently taken a second young wife, and it is said he even gave *kalym* (bride-money) for her. Please announce the village and the deed of its president, so that our people may be shamed into action; but do not give my name for I fear his vengeance." The announcement was made; two weeks later word came that the village had been so startled by having its backwardness exposed to all Central Asia, that they held an emergency election meeting and ejected their president.

Another letter came from a peasant woman, who could not read or write herself, but who had begged a travelling representative of the Women's Movement to write for her. "Since I unveiled, my husband beats me mercilessly," she said. "Please announce this fact with his name and the name of our village, so that he may be shamed before the neighbours in our village club where we have a loud speaker." To the woman herself there seemed nothing incongruous in her request, which was promptly complied with, but it is hard to imagine a land modern enough to have loud speakers in village clubs and yet so backward that a husband beats his wife for unveiling.

#### The Village Club.

"What connexion," Mr. Schneider was asked, "have these distant places with any government?" "They have their village Soviet president, but he is often illiterate or dishonest. They appeal perhaps to the county and find it corrupt. Somewhere higher up they believe there may be justice, but they do not know to whom to appeal or how. So they write to the radio station, the only place they know in the big town." The government realizes what a valuable connexion it is with distant peoples. They have increased its budget every year, and will doubtless continue to do so. A case cited to show the appreciation of wireless was that of a village high in the Pamirs, beyond mountain passes which can be crossed only for a few weeks each summer. All the rest of the year the villagers are shut from the world entirely, except through an occasional mountaineer who risks his life to cross the high snow peaks. He comes to Tashkent and brings a message to the broadcasting station. "On such and such a day in our village," he tells us, "we are to open our club with a new loud speaker. We would all appreciate it very much if you would send us congratulations over the air." He tells the achievements of the new club and its problems; and on the appointed day, half the celebration is in the excitement of hearing about themselves from the distant city.

I returned to the broadcasting station in the evening

and listened to its programmes. A concert was being played on the strange stringed instruments of the Uzbeks, with very long handles and strange excrescences to catch and return the sounds; the *dutar*, the *tambour*, the *gidzhak*—I took down their names as they were pronounced to me. The *chang*, or *zither*, was the only one that looked at all familiar. The orchestra played ancient Turkish marches, Arabian love-songs, prayer-chants of the Uzbeks, but no European music. The music of the West displeases Central Asians; they write many letters protesting against the programmes of European music, "those strange sounds that hurt our ears." It is not the protest of a people ignorant of music, but of those who have and love a different music of their own. The Uzbek music cannot be written on any tonal system of notation we know. Five hundred years ago they had a system of writing it; this is now being revived from old monuments, and it is expected to develop a way of preserving in writing the Uzbek music which has passed from musician to musician across the centuries.

It is interesting to reflect that the latest wonder of modern mechanical science, in doing so much to widen the range of the Uzbek music, may be instrumental to the discovery of records regarding this ancient art of the East.

#### A New Use for the Fultograph.

AN enormous amount of research into the origin and nature of atmospheric has been done in recent years by the Radio Research Station at Slough. The station is now to make use of an entirely novel method of recording atmospheric. The Royal Meteorological Society has arranged with the B.B.C. for special Fultograph transmissions after the normal picture programmes, and these will be picked up by Fultograph receivers installed for the purpose at recording stations in various parts of Europe. The transmissions will not take the form of pictures; instead there will be sent out a series of straight lines, both horizontal and vertical, forming a grid or network. When an atmospheric occurs deformations of the straight lines will take place to an extent depending upon the intensity of the interference. It is hoped by this means that it may be possible to make records giving the most valuable data for research into the intensity, duration and origin of individual atmospheric. As the drums of all receiving apparatus are synchronized, it will be possible by comparing the results obtained in different places to determine the range at which an individual atmospheric can cause interference and also the intensity in different localities.

## The Greece of the Far East—II.

By the Rev. Walter Weston, M.A.

*Late Honorary Secretary of the Japan Society.*

*Continuing his comparative study of the Greeks of classical times and the Japanese of to-day, the writer here deals with the social and religious aspects of the two peoples. Striking resemblances are found in such matters as family tradition and burial rites.*

WHILE in a fondness for athletics and bodily training the ancient Greeks have been compared with the English, they also bore a more remarkable resemblance to the Japanese in many striking points of detail regarding the customs, manners, and religious practices of the two peoples. We will here think of the Japanese in a general way, as represented by the ordinary type, which is as yet little touched by Western Civilization, and of the Greek as we find him, mainly in Athens, during the age of Pericles.

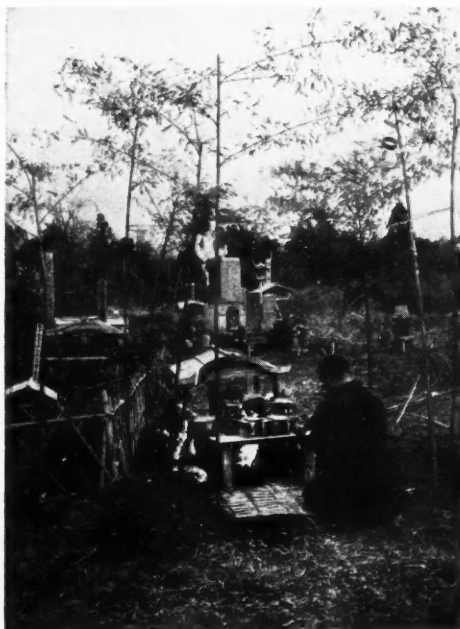
Although a considerable difference is to be seen in the *mental* characteristics of the two, a remarkable likeness strikes us in the *moral* virtues of justice, courage and temperance. In both cases, also, it was law and good manners (Japanese *memboku*, "face") which controlled action, rather than the deeper and worthier sentiments of right and wrong. Nevertheless, while the Greek was far more richly endowed with qualities that stimulated thought and action, it is the Japanese in whom we find a greater capacity for self-sacrifice of the utmost imaginable degree.

In each case we have a man of moderate diet, largely vegetarian; and if the Japanese did not equal the Athenian in "high thinking" he certainly was not inferior in "plain living." Both were modest eaters, normally, and fish was perhaps their most valued food. What the olive was to the Athenian (by whom it was dedicated to Athene), so is rice to the Japanese, who for it worships Inari-sama, the Goddess of Food, as the special guardian of his crops. In both

countries, which supplied a simple, frugal, yet wholesome and sufficient diet, we find a people able to move about in the open, usually with the head uncovered, with nothing but sandals on the feet, and with clothing simple and light. Spending so much of their time out of doors, houses were arranged for shade rather than for light, and contained no fixed fireplaces except in the kitchen. Each warmed his cold rooms with a movable brazier, the Japanese *hibachi* (firebox) also being filled with glowing charcoal for the purpose. In a general way each adapted himself as circumstances permitted to his physical environment, although this was a rather more complicated matter for the Japanese since the peculiar position of his country renders it liable, for the most part, to greater extremes of heat and cold. Tables were little used

except at meals, being carried in and out with the food and the vessels containing it. In both countries the ladies' hand mirrors were of polished bronze, circular, and decorated in relief upon the back. Though the furniture of the house might be considered by most of us very scanty, there was a wonderful blending of gracefulness and utility.

As regards the amusements of the two peoples, it has been observed, with much truth, that the Japanese theatre must be more like the theatre of ancient Greece than anything now extant. The points of resemblance are too numerous to discuss in detail here, but in the case of the former we must draw a distinction between the performances given at the popular theatres, or *kabuki*, and the *Nō* or lyrical dramas



ANCESTOR WORSHIP.

Japanese praying at a grave on the festival of All Souls' Day, just as the Athenians regarded it as a duty to carry decorative offerings to the tombs of their ancestors.

which were produced for the entertainment of the exclusive and observative upper classes. It is the *Nō* with which the Greek theatre has so much in common. Both can be traced back to religious dances of immemorial antiquity, accompanied by rude choric songs. In theme they were both quasi-didactic, presenting the character and deeds of gods and heroes, the supernatural predominating in both, and in construction they were alike lyric. Each had as a chief element a chorus, which was located on the stage with the actors. There was a similar type of orchestra, the actors were men, and masks were worn to portray, in a primitive manner, the peculiar character and moods of the various *dramatis personae*.

Another subject in connexion with which some remarkable and significant resemblances are bound to strike us, is the position of woman. In spite of the fact that both nations produced women whose names are famous, in a general sense their seclusion was the rule, and as a natural consequence they became both physically and intellectually the inferior sex. What made matters worse was the fact that their ignorance and inferiority grew to be regarded as natural rather than acquired. The woman's share in the home was solely that of the house-wife and house-mother, and she received no education beyond that of the corresponding domestic accomplishments: in each country she was made to feel that *her* place was inside the house. Indeed, the common term by which the Japanese husband has quite usually spoken of his wife has been one which signifies "the thing that lives in the back part of the house"! Plato tells us that the special excellence of a woman is to keep house well and to obey her husband. Sophocles makes Ajax to remark "Woman! women are adorned by silence"; and Xenophon maintains that it is her duty to "see as little, to hear as little, and to ask

as few questions as possible." And yet, strange as it may appear, it was in the greatest age of Athens that women were least important.

In both countries marriages were usually arranged by *professional* matchmakers; but while the Athenian wife never passed wholly under the full power of her husband and was by law connected all the time more closely with her own family than with his, with

the Japanese wife the converse was the case; she was virtually regarded as dead to the claims and the authority of her family, and in the marriage ceremony itself special emphasis was laid upon this fact. In both cases, divorce for the man was easy, and difficult for the wife, but, happily, the theory was much more strict than the practice.

In the matter of religion in its widest sense, and of religious practices, the Athenian had much in common with the Japanese of whom we are specially thinking. On the outer door of the Athenian house we should notice a knocker, usually consisting of the familiar ring in a lion's mouth, the original purpose of which was to scare away evil influences, in keeping

with which some inscription such as "Let no evil enter here," would be added. A drawback to this was the chance given for the sarcastic gibe—"But how, then, is the owner to get in?" In the case of the Japanese dwelling we find exactly the same prophylactic practice in vogue. On the lintel, or on doorposts, I have often noticed little pictures of a horse, to indicate that the master was away on a journey and that therefore the burglar's call would be futile; or a child's sandal as a similar warning to the demon of measles or other inflictions of childhood. Occasionally the picture would be that of some monster of terrifying aspect which should of itself produce the desired deterrent effect.

Indoors, in the open middle space of the Athenian house, would stand the domestic altar to "Zeus of



WRESTLING DISPLAY.

The love of games is prevalent among the Japanese, where the art of wrestling is specially developed and displayed in public performances.



the home," at which on appropriate occasions the house-father would officiate, surrounded by the family and slaves, just as they are found in devout Japanese Buddhist homes to-day, for few houses in Japan are to be seen without their shrine and the little "God-shelf," on which are placed the customary offerings of rice and wine.

In regard to religious belief, there was much in common, in a combination of Nature-worship and the cult of ancestors, for the religion of the Athenian was closely akin to that of these Japanese whose profession was that of the Shinto cult rather than of the Buddhist creed. Both, also, show us the extremes of people either always consulting soothsayers and practising exorcism, or, on the other hand, as in the case of the thinkers and philosophers, doubting as to who or what the "gods" may be, or whether such really exist at all. But the creed of the average man is a creed which, for the most part, sits easily on both, and on the whole it has been a fairly cheerful and festive thing, delighting in holidays, processions, sports, and feasts. Of the divinities

they both worship, there are some who are invoked for favours in the way of health, happiness, wealth and success; others, however, are only offered sacrifice because to neglect them is to run the risk of dire visitations and manifold ills.

It must, of course, be allowed that there were many persons, in both lands, of that earnest and thoughtful kind who felt that the gods must surely look with approval on the man of good conscience and of clean life. It was even so in the case of the band of white-robed pilgrims whom I one day met near the summit of the great sacred peak of Ontake in Central Japan. Enquiring the significance of their white garments, I was told: "We are going to worship the Mountain God, but he will only hear the prayers of those who come with clean hands and a pure heart. We wear

these white clothes to show that that is what we seek and strive for."

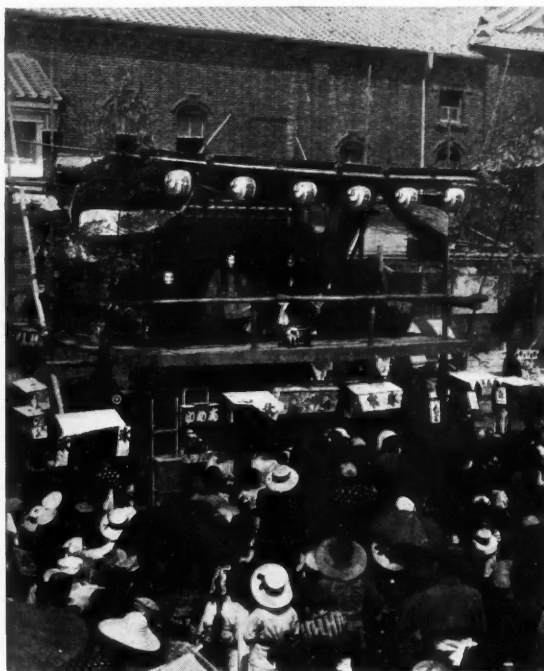
Nevertheless, of the average person in both cases, it is, on the whole, true that there is comparatively little connexion between his worship of the gods and his moral conduct towards men. The standard of purity, whether of "heart" or "hand," was mainly the standard erected by society and the law, and not

an ideal made known by revelation. It is quite in keeping with this attitude that religion in Athens, as is the case with Japanese Shinto to-day, was made a matter of State concern and put under the general supervisory officials.

As among the mass of the Athenian populace, there was in Japan the same traffic in divination and in the practice of those occult and ecstatic ceremonies which I had opportunities of observing among the members of the pilgrim bands who carry on the cult of the mountain divinities, to the more important of whom shrines are also dedicated in some of the larger cities of the plains. In the matter of votive offerings at the shrines of the divinities worshipped,

Japanese and Athenian both laid no restriction on the objects he was disposed to present. With the latter it might be some costly cup of precious metal or some other work of art; with the former, if well-to-do, a magnificent lantern in bronze or stone; if of smaller means, a model or picture of the trade he pursued.

The attitude of both peoples towards the after-world was so identical in most respects that what Professor Tucker has written in his "Life in Ancient Athens" may with equal truth be accepted as descriptive of the average Japanese: "The comfort and honour of the dead in the region beyond death were held to depend upon the attention paid to the corpse and to the place where it was buried. A ghost who had no posterity on earth was . . . in a lamentable



THE KAGURA.

Stage on which is proceeding the *Kagura* dance, probably the most ancient rite of its kind in Japan. Popular heroes are celebrated as in ancient Greece.

plight in Hades." Apart from the pressure of public opinion and ideas of "good form," from encouragement by the State, and from considerations of his old age and its environment, the citizen had this strong motive prompting him to undertake what otherwise he might have been disposed to avoid: every individual desired to leave behind him someone, not merely for the usual and natural motives such as to continue his family and inherit his possessions, but who would be able, before and above all, to bury him and to pay due honours to his body and his tomb. This was one of the most potent factors in inducing both Athenian and Japanese to accept the cares and responsibilities of the married state, which otherwise to many was a prospect anything but welcome.

In the view of the ordinary Japanese, the worst and crowning misfortune that could befall him was to be left an unburied and unhonoured corpse. And to this view the Athenian clung no less fervently; for he held that Charon would not then receive him into his boat for the crossing of the Styx, and the poor ghost would be left to shiver, helpless and miserable, between the confines of the two worlds. The gifts placed in the grave by the Athenian were almost the same, and for corresponding reasons, as those provided by the Japanese, at least until modern times. There were similar ceremonial lustrations with water. In either case the body might be buried or cremated. If the latter, the remains were disposed of in identically the same way. Although the Athenians apparently celebrated no such touching rites as the yearly *Bon Matsuri* of Japan, when the "Welcome Fires" are lighted to guide the returning spirits on their way home for a brief visit, yet they, too, by the same natural instinct, regarded it as a duty to carry their offerings and decorations to the tomb, and to perform similar domestic ceremonies, on the third, ninth, and thirtieth days after the death and also on the birthday of the deceased. With the Japanese, however, the prescribed days for the visits were the eleventh and thirty-fifth, and also on

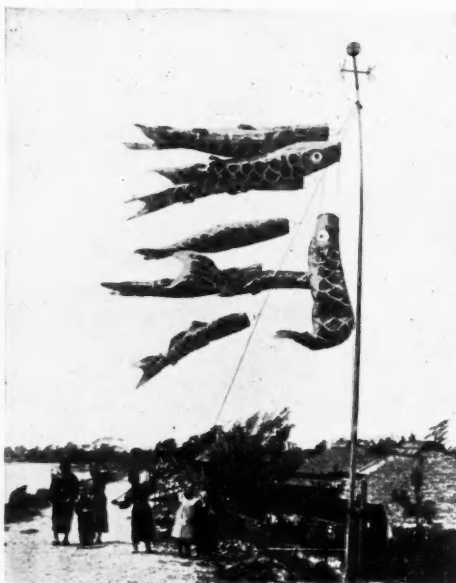
the first and third anniversaries of the death of the departed.

Many and varied are the means by which Japan has striven to keep alive in the hearts of her people the sense of obligation to the honoured dead for their deeds of valour and their acts of self-sacrifice. Over the whole country are to be found the *Kagura* stages, where performances are periodically given of the dance

which is probably the most ancient rite of its kind in the land. The word itself signifies "The Seat of the Gods," and the dance is intended to teach its onlookers their community with the departed in the fellowship of noble deeds and unselfish devotion to the country's welfare. It sets forth in a highly dramatic form the lesson of how the "Divine Ancestors" fought for and conquered the land for their descendants, to whose keeping they have committed it, and that the "Gods" are always on the side of those who are ready to strive and to suffer for their sacred heritage. Most moving and inspiring of all such celebrations, however, is the festival of the great national shrine on the Kudan Hill in Tokyo, held both in spring

and in autumn. The sacred building is regarded by the Japanese as their Westminster Abbey, their Ceramicus, for here is paid grateful homage to those who have died in their Country's cause.

In the moving and memorable oration which Pericles is represented as having himself once delivered, we have the very embodiment of the creed of Athens and of Greece. And no one who has listened to the discourses of men like General Nogi, when commemorating the martial virtues and loyal self-sacrifice of his warriors at Port Arthur, can help feeling that here, more than anywhere else, these two peoples are at their best and most like to each other when they are able both to extol and to practise, as their highest virtue, the supremest ideals of self-sacrifice. There is still a world of meaning to which the *Yamato-damashii* "the Japanese Spirit," can respond, in the noble declaration: "The whole earth is the tomb of good men."



THE BOYS' FESTIVAL.

At the beginning of May, paper kites made in the form of the carp—the symbol of brave effort in life—are flown over Japanese houses which boast a male heir.

*The "Next Step."—IX.***The Synthetic Chemistry of the Future.****By J. F. Thorpe, F.R.S.,***Professor of Organic Chemistry, Imperial College of Science and Technology, London.*

*That the recondite knowledge of one generation is the technical practice of the next leads the author to suggest that further advances in chemistry will follow mainly the path laid down by the great pioneers of the last century without any abrupt break.*

A SURVEY of the work of the past sixty years shows that research and development in the field of chemical science have advanced mainly through the influence of a few major principles which have dominated the minds of investigators and have led them to carry out their enquiries in certain definite directions. The whole structure of modern organic chemistry, for example, could not have been raised had not the conception of the tetrahedral carbon atom been initiated and developed by Van't Hof. The earlier type theory could not have given the same impetus to investigation as that imparted by the structural theory, neither would it have been possible by its help to create the science of organic chemistry as we know it to-day.

Let us try to place ourselves in the position of an investigator on the organic side of chemistry in, say, the year 1860, and let us attempt to appreciate the difficulties with which he was then faced. At that time Kekulé's "Lehrbuch der Organischen Chemie" had just been published—a book which supplies a striking example of a young man, full of new ideas, yet unable on conventional grounds to give them complete expression. For the science of organic chemistry was at that time in the transition stage. Chemists were just beginning to realize the need for three dimensional formulae which would provide them with some mechanical representation of the molecules with which they dealt. But there was, as yet, no clear sighted vision, and as Kekulé points out in his book, there were then no less than twelve distinct two dimensional formulae for acetic acid.

**Early Organic Synthesis.**

In attempting the synthesis of a natural product the chemist of those days found himself possessed of good and adequate means for determining its qualitative and quantitative composition, and in this way he could arrive at a correct empirical formula. But further than this he could not go unless, as sometimes happened, luck served him to an altogether surprising degree. To-day we know that the determination of the empirical formula of a natural substance does not supply much information in relation to its

structure or possible mode of synthesis. There are so many possible compounds of the same empirical formula—many thousands in fact—and any hope of preparing the right one by empirical deduction rests on but a slender foundation.

**Three Dimensional Formulae.**

The influence of the introduction of three dimensional structural formulae on development was profound, for whereas no important advance in synthetic organic chemistry occurred between the years 1828—when Wöhler synthesized urea—and 1865, the ensuing thirty years constituted the most fruitful period in organic chemical research and investigation, and witnessed such wide-reaching achievements as the syntheses of alizarine, indigo, and uric acid.

What then is the next step that is likely to aid in the direction of organic chemical investigation? Undoubtedly it involves the proper understanding of the electronic condition of the organic molecule and of the part the electron plays in determining the course of organic chemical reactions. The structural theory has played, and will continue to play, an all important part in predicting and determining the changes organic substances undergo, but the theory is limited in its scope because it is only quantitative up to a certain point. There are so many variables that cannot be controlled and the presence of which can, in many cases, only be inferred. The mechanism, of even the simplest reactions, is unknown, and cannot be known until we gain further insight into the structure of the molecule as a mobile entity. If it can be assumed that the major factor determining the course of a reaction is polar, then, obviously, the electron shift through the chains or rings of carbon atoms forming the molecule is the prevailing cause of all reactions other than those which are controlled by such factors as appertain to steric conditions. The electron shift must be a definite quantity, but variation and ambiguity arises owing to the molecular conditions which tend to produce the shift. It does not suffice to indicate the tendency and direction of this shift by means of such devices as a curved arrow, because,

to be of use, we must know, in quantitative terms, exactly what that arrow implies. Until this is done the determination of the quantitative polar effect imparted to any part of the molecule of an organic substance cannot be determined, and prediction, except in extreme cases, cannot be made.

The vast number of facts which has accumulated during the past sixty years, both in synthetic organic chemistry and in the inorganic branch of the science, has led to a wide advance in physical investigation in order to correlate physical phenomena with chemical composition and chemical reactions. Indeed, it is impossible to-day for an investigator to work in any branch of chemistry without a wide knowledge of the physical side of the science, and the chemist now looks to the physical chemist for the solution of many of his problems. The wide range of investigation which has been opened up by X-ray analysis and by the intimate study of colloids, provides material for research which will throw light on the inner structure of the molecule and will supply the means by which many of the obscure processes of nature can be understood.

#### Petroleum and Fuel Hydrocarbons.

The manufacture of the high-compression ratio internal combustion engine for use in motor vehicles has increased, and is increasing, both in this country and in America. The justification for this step is the increased mileage per gallon that can be obtained. But there are difficulties which have to be overcome, because normal motor fuels will not withstand high compression without producing the phenomenon of "pinking" or "knocking"—due, in all probability, to premature ignition in the cylinder. This unpleasant feature, familiar to all who drive, may be overcome by the provision of the correct type of hydrocarbon mixture, namely one that contains a high proportion of hydrocarbons of the "aromatic" type. The term "aromatic" is used amongst petroleum chemists in a wide sense, and is made to include not only the true aromatic hydrocarbons, but also those of ring structure containing a higher percentage of hydrogen.

It is well known that these hydrocarbons, and also those which are olefinic in character, reduce the tendency of a fuel to "knock," and hence recourse is had at the present time to the practice of "cracking," not only of petroleum, but also of the low temperature coal distillation oils, since this operation yields the desired substances in considerable quantities. Research work in the future will be concentrated on these problems, and means will be devised for utilizing the gaseous hydrocarbons which are formed in varying amounts at the same time. Indeed,

the utilization of gas produced in this way, as well as of the gaseous hydrocarbons of natural origin, are problems which must be solved in the near future. Already the valuable olefines present in the "cracked" gases are being utilized for the production of alcohols, suitable as solvents of glycol now required in large quantities for the production of non-freezing nitro-explosives—as well as of a large number of substances which, until now, were mainly regarded as chemical rarities. The question is one of great importance in connexion, for example, with the natural gases of Canada and also that which is daily evolved from the oil fields of Persia.

#### Pressure Reactions.

The application of pressure both in organic and inorganic reactions has opened up a wide and fruitful field which must be developed in the future. The successful application of the Bergius patents for the production of oil from coal and the later discovery that methyl alcohol can be formed from carbon monoxide and hydrogen indicate two industrial applications of the method. The influence of pressure on chemical reactions in the presence of a suitable catalyst is, however, far more deep-seated than this, and there can be no question but that the utilization of developments in these directions is opening up a new field of organic and inorganic chemical research.

All over the world vast factories are being installed for the production of artificial fertilizers from the nitrogen of the air, and the utilization of nitrogen in its "active" state will also provide a means for preparing many of the organic nitrogen compounds used in industry. Already reactions which, twenty years ago, were regarded as impossible, such as, for example, the production of phenol and aniline directly from chlorobenzene, are being carried out on the large scale and show sign of ultimately replacing the older and more costly processes. Moreover, substances, such as adipic acid, which were formerly obtainable only in small quantities and at considerable cost, are now readily available, owing to the ease with which catalytic hydrogenization under pressure transforms the aromatic hydrocarbons into their saturated ring prototypes and from these, dibasic acids suitable for many industrial purposes, can be produced.

The numerous methods for the production of hydrogen, essential in these reactions, are certain to be increased in the future, and use is likely to be made in this connexion of coke oven gas, which contains a large percentage of the element. So far the cost of this method has been prohibitive, but, as the world's need for hydrogen increases, every source of supply for this element will have to be utilized.



It is inevitable that alterations in the economic conditions of a country due to legislative and other causes should produce a profound effect on the chemical substances needed by that country. Such is the case in the United States of America, where the Prohibition Laws have exercised a wide reaching effect on the manufacture and use of alcohol, both as a beverage and as an industrial product. America produces enormous quantities of molasses in its sugar refineries, which, by selecting suitable ferments, can be made to yield a very pure form of glycerine; in addition to its use for the manufacture of ethyl alcohol which is rapidly increasing in industrial importance for conversion into ethylene, glycol and esters for solvents.

Other curious examples of the effect of economic conditions are found in the increased use of caffeine in "soft" drinks, which has led to the production of this substance from the theobromine derived from cocoa and also from methylated uric acid. Indeed, the extraction of caffeine from coffee itself is now carried out on the large scale, the extracted coffee being just as palatable as that containing the extracted ingredient. All this shows that "the recondite knowledge of one generation is the technical practice of the next," and that however rare and scarce and apparently useless a new compound may be, as soon as a demand for it arises its production on economic lines rapidly follows.

#### Biochemistry.

The organic side of biochemistry continues to develop, and already amazing results have been achieved in the synthesis of natural products playing an all-important part in animal and vegetable metabolism. It is becoming increasingly clear that our bodily functions and the conditions of health, and ill-health, are mainly determined by definite organic substances secreted and excreted by the glands. Herein lies a wonderful field for further investigation. Already we have insulin, thyroxine and the sexual hormone—to mention only a few—and each of these plays its part in determining physiological balance. It is reasonable to suppose that the functional rôle is played by the pure organic substance, and in this way biochemistry may be regarded as a branch of organic chemistry and will be subject to development as such. But it cannot be supposed that it is the pure crystalline organic compound that exercises its effect, but rather that it functions in the form of some colloidal complex—a condition with which the physical chemist must deal. Indeed, the researches of Willstätter on the enzymes show that increase of purity leads to decrease of activity, and the deduction to be made from this fact is that the reactive principles

are balanced mixtures of highly complex substances and that any attempt to destroy the balance leads to diminished activity.

The chemist, as such, has few means at his disposal for dealing with complex mixtures of this type, for his province has hitherto been to isolate and investigate pure, homogeneous substances only. Nevertheless, it is clear that all mixtures must be composed of pure substances, and the problem of the future will be to determine the character of these pure components, and then, by mixing them, to reproduce the original active material. This is a difficult field and one which may well appal the most daring investigator, but work in it is well worth while for even a small step in advance will yield results of the highest importance because a knowledge of the nature of the enzymes and their mode of action must be acquired before any real attack can be made on the chemical reactions which take place in the living cell.

#### Vitamins.

One of the most difficult and intricate problems which will occupy the attention of the next generation will be the study of the nature of the vitamins. No doubt much has been written and published concerning these substances which will be subject to revision in the near future, but already it is clear that they are complex organic substances capable of exerting their power in extremely small quantities. The most interesting and definite appears to be vitamin D which can be formed in irradiated ergosterol. Organic chemists are familiar with many substances, which, when subjected to ultra-violet radiations, absorb energy and pass into meta-stable compounds, which in their turn pass back under suitable conditions into their more stable isomerides liberating, at the same time, the energy imparted to them. It is possible that ergosterol may act in this way, although the chemistry of this substance is still obscure.

Meanwhile, research in connexion with the structures of the more definite products of life is being carried forward. Strychnine, brucine, quinine, and other alkaloids still, it is true, elude the skill of the investigator, but our knowledge of these substances increases steadily, and it will not be long before their syntheses are effected. The natural colouring matters are gradually being prepared and there are now few remaining questions unanswered in this field. The chemistry of the sugars and also that of starch and cellulose will continue in the future to form subjects for investigation, although the structures of the simpler members of this group are now clear. The industrial importance of cellulose as a source of

artificial fibres is likely to lead to increased activity in connexion with its chemistry—which is still obscure. We know that both starch and cellulose are based on glucose and it is an easy matter to break them down artificially to this sugar, but no one has yet succeeded in converting glucose into alcohol and carbon dioxide by laboratory methods, and until this operation, which is so easily accomplished by a suitable enzyme, is reproduced, we are hardly in a position to boast that we are able to improve on the processes of nature or to follow them even in their simplest manifestations.

The next step in chemistry is, therefore, one which will follow, in the main, the path laid down by the great pioneers of the last century. There will be side tracks, as there have been during the preceding

period, and some of these will open up new country which will be, for the most part, borderland regions between chemistry and other sciences. The main track will become increasing steep and more and more arduous to follow, but there will be no abrupt break, and, although there will be, occasionally, fog ahead, it will gradually be dispersed by the light of the newer theories which those following after will be able to shed. For the facts which have accumulated during the past eighty years, and the manner in which they fall into their allotted places, stand as milestones along the path of progress and show that the road on which we travel must be the right one. We have, then, only to struggle on in order to reach the summit, immeasurably distant though it may be.

## Why Britain Needs a Race Survey.

By E. N. Fallaize.

*Honorary Secretary, Royal Anthropological Institute.*

*Anthropologists seriously stressed the importance of a Racial Survey in Britain in the evidence collected by the Inter-Departmental Committee on Physical Deterioration in 1904 which led to the Medical Inspection of School Children. That the value of such a survey would have been inestimable in 1914 is one reason for again urging its practical utility.*

WHEN the system of classifying recruits into categories according to their physical development and health became of general application over a wide range of the male population during the war, it emphasized the fact that previously information as to the nature and distribution of the physical characters of the population of the British Isles was almost negligible.

Among those who were most emphatic in calling attention to the absence of data for determining whether physical deterioration among the population at large was really taking place were the anthropologists. They pointed out that relatively few measurements had been taken, that they were partial in distribution and unsystematic and that they were insufficient for any valid conclusions either as to a change in the character of the physique of the population or as to the correlations of race, physique, health, incidence of disease and the thousand and one other matters bearing upon the problem upon which public attention was then focussed. As anthropologists, however, they were primarily interested in the racial question and pressed for an anthropometric survey of the population of the whole country. This was set aside—indeed it was hardly seriously considered—for the more immediately practicable and utilitarian measure of school medical inspection.

This was in part, no doubt, because a survey of the racial composition and distribution of the population was regarded as of too academic a character to justify the expenditure of the undoubtedly large sum of money which it would entail.

It is hardly necessary to point out the inestimable value an accurate and detailed survey of the physique of the population would have been in computing man power at the beginning of the war. This need was not to be foreseen; but even in the more restricted province of the medical inspection of school children, the absence of data was sometimes responsible for errors in diagnosis. Variations in stature were regarded as significant of malnutrition where probably a racial factor was present which was undetected because the subjects had been compared with a standard for the country as a whole instead of with a standard based upon measurements drawn from a comparable racial element in the population, in which stature would have shown a variation from the general average of the population.

It is evident that a complete anthropometric survey of the population would be a costly undertaking. But if the urgent need for such a survey were realized, the question of expense would not weigh heavily against the advantages. In such a question, for

instance, as the incidence and geographical distribution of disease, a subject about which very little is known, it has been suggested that a certain physical type of the population—the blond—is particularly liable to pulmonary complaints. Yet it has been stated by one observer that in an area of one of our large cities few of the children were free from some signs of tuberculosis. This particular area from the earliest times has been a home of the short dark element, the type who are said to be peculiarly liable to the disease in Wales.

#### Deterioration of Type.

Another question upon which an anthropometric survey would throw light is the effect of migration to the city from rural areas on physique and type. A popular view once held was that a family migrating to London from the country died out in three generations. It is, however, more probable that it is the tall, fair type only that is impatient of the restricted conditions of city life, while the short dark type survives even in the unhealthy conditions of the great manufacturing cities of the north. In such questions as these, while conditions and their consequences are known—yet it is only to some extent and imperfectly—data are not adequate to warrant more than a possible conclusion on any general lines. To appreciate the significance of the racial factor, far more comprehensive information, such as could only be supplied by a complete anthropometric survey, is essential.

The merest superficial observation in walking along the streets is sufficient to indicate the mixed character of the British population. It would be hard to say that any one type predominates, and the variations in combination of the different physical characters seem innumerable. It is possible, however, to form a rough classification in which may be ranged the characteristics of the two basic types. On the one side is the tall, fair-haired, light-eyed and long-headed Nordic; on the other the short, dark-haired, long-headed Mediterranean. Variations in the combination of colouration and stature of the two main types are readily to be distinguished; we find such combinations as tall but dark, or fair hair with dark eyes, and so forth. Head form, the anthropologist's primary index of race, is less readily to be discerned without precise measurement of the head. Except, therefore, in the more marked cases, the broad-headed element in the population passes almost unnoticed.

The evidence of the skeletal remains found in the graves of the prehistoric and early peoples of Britain gives a fairly clear indication of the racial history of these islands. Of all the three races into which the

people of Europe are divided broadly—the long-headed, short and dark Mediterranean, the broad-headed Alpine of medium height and complexion, and the tall, fair, long-headed Nordic—representatives are found in early Britain. The succession of races is familiar. Ignoring finer distinctions, in the Neolithic period the population was of the Mediterranean type, a nomadic or semi-nomadic pastoral people, subsisting to some extent on hunting and perhaps already at the time of their arrival cultivating some food plants. At the end of the Neolithic and beginning of the Bronze Age, broad heads from Central Europe appear, agriculturists relatively advanced in culture and social organization in comparison with their Mediterranean predecessors. It is probable that this Beaker Folk, as they are called from the characteristic piece of pottery which forms part of their grave furniture, had already some admixture of Nordic blood, as they are not characteristically of the unmodified Central European type, and in the successive migrations from Central Europe, the admixture becomes more marked. In the Iron Age follow successive migrations of long-headed peoples, typical Nordics. Neither Roman nor Saxon, nor even perhaps the Norman invasion, politically important as they were in our history, added much that was entirely alien to our ethnic composition. The Saxons were Nordics, as were the Normans, while the people who formed the rank and file of the Norman army already had been closely associated with the Britons, as Caesar had found by bitter experience, and, therefore, it may be assumed, were not too distant blood relations.

#### Regional Types.

This succession of migrations combined with Britain's insular position has had a marked effect throughout our history. Even when the elements of the successive incursions have been closely akin, there have been differences of physique and still more of culture. These have persisted in a remarkable way so that in modern Britain, notwithstanding modern movements of the population and the rapidly increasing facilities of transport, differences may be noted almost in passing from county to county, and very often within the boundaries of a single county. The basic physical types remain, even if individuals show evidence of the admixture of blood, and broadly the original distribution is unaltered. From east to west, along the lines of penetration of the invaders, the type passes from the blond Nordic of the east coast by gradation, becoming darker as the observer goes westward, until the dark Mediterranean of Cornwall, Wales, and Western Scotland becomes the predominant

type. Yet there is abundant evidence that the popular view generally held that the Britons were exterminated by the Saxon invaders or pushed westward, is not in accordance with the facts. The most striking example is in the pockets of short dark people which survive in various parts of the country such as that observed by the late Dr. Beddoe in Yorkshire. Here then, we have a survival practically unchanged of the early invading races. Possibly in the remoter parts even a few members of the palaeolithic peoples may have survived, but their numbers are not sufficient further to complicate the problem.

The difference between the various invaders of Britain was not only one of physique. They differed in culture, in social organization and in religious belief. As regards the last named, we find evidence in the method of burial. In the Bronze Age, by some the body was laid in the ground intact, by others the body was burnt upon burial. In the Neolithic period the body lay on its side, with the knees drawn up to the chin. In Iron Age graves the body is extended and lies on its back. Each variation indicates some distinctive religious belief connected, it may be assumed, with some variation in the conception of the soul and the life after death.

#### Cultural Differences.

It may be thought that the investigation of the physical characters and even the culture of the Early Races of Britain has little bearing upon the practical problems of modern life. But the study of the survivals, the folklore of the British people, shows that beliefs and customs of the people, many of them alive to-day, others which have died out only recently, can be explained only as relics of beliefs which long ago were officially superseded by Christianity, and of a social system which disappeared with the institution of a centralized authority. The belief in the witch, for instance, strongly persistent as it still is, could only originate among a people to whom magic was the normal explanation of events. Well worship, which survives in the custom of throwing pins into the water, and the custom of hanging rags on adjacent thorn bushes in the hope of the fulfilment of a wish, is to be traced back to a race with whom the spirit of the water was an object of veneration because water was a matter of concern. A pastoral people of the downland where water was scarce, and is still in modern times, collected it perforce in dew-ponds. It is at least a striking fact that well worship is still especially prevalent among the darker populations in the country, though it is by no means confined to the areas where this type is especially predominant.

Further instances of the survival of a primitive mentality among the people, as indicated by the existence of customs and beliefs which no longer have a place in our culture, could be multiplied indefinitely. Close study of these survivals suggests that with further investigation it might be possible to assign many of them to an appropriate racial origin and possibly to the mentality of a type to which it was peculiar. The very persistence of these beliefs among a section of the population assures a difference in mentality which cannot but have an important bearing upon the relations of different classes of the population.

#### Mental Characteristics.

To suggest that it might be possible to differentiate mental as well as physical characters as between the different races in our population, is to enter upon the domain of speculation. Psychologists have not yet devised any satisfactory method of studying mental characters, beyond sense perception, in which the personal equation of the observer can be eliminated. Yet from the days of Herodotus, travellers have agreed in attempting to formulate an estimate of the variations in mental character of the peoples they have visited. When due allowance has been made for the influence of environment in the broadest sense, nationality, natural surroundings, training, social organization, and the like, there seems to be a residue of difference between races which may well be due to an innate mental constitution and may be a factor in inheritance just as much as such physical characters as complexion—eye and hair-colour—or head-shape.

If once it were admitted, even hypothetically, that such racially differentiated mental characters exist, the problems which come well within the purview of a knowledge of the constituent racial characters of the people are enormously increased in volume and importance. The anthropologist presses continuously for sympathetic knowledge of the mentality of the governed in the solution of problems of administration. This applies as much to civilized as to the uncivilized peoples. How far are our industrial difficulties an outcome of racial misunderstanding and how far are the social and moral problems which confront us since the war due to a change in balance between the Nordic and Mediterranean? From the earliest times the Nordics have been the rulers and leaders of communities largely composed of conquered peoples. Owing to the war and economic and political causes, the social predominance of the Nordic has diminished. Is class war fundamentally a race war of conflicting ideals? For the solution data are lacking.



## The Formation of Hail.

By C. E. P. Brooks, D.Sc.

Honorary Secretary, Royal Meteorological Society.

*Hailstones five inches in diameter are reported to have fallen recently in India. Such a phenomenal occurrence gives rise to various problems regarding the formation of hail, a subject which has long puzzled all scientific observers, and about which there are still many unsolved problems.*

ONE of the earliest weather records extant concerns the hail which "smote throughout the land of Egypt all that was in the field . . . and brake every tree of the field." To-day from time to time we hear of similar occurrences,

masses of ice weighing a pound or more falling from the heavens, crashing through roofs of corrugated iron or tiles, destroying crops, and sometimes killing children and cattle. They have been estimated by careful observers to be larger than oranges and even as the size of a melon. In a hailstorm in Trichinopoly on 11th May

this year, subsequently described in *The Times*, a hailstone is reported over five inches in diameter, and in that hot climate the ground was white with hail for more than an hour after the storm. The damage done by hail is due not only to the weight of the ice, but also to the velocity with which it falls. It has been calculated that in still air a spherical hailstone half an inch in diameter would strike the ground with a speed of 22 miles per hour, one an inch in diameter at 31 miles per hour, and one four inches in diameter at 62 miles per hour, the rate of fall increasing in proportion to the square root of the diameter. A violently thrown cricket ball travels at about the same speed as a four-inch hailstone.

So striking a phenomenon as hail naturally attracted attention in all ages, but in the early days the main difficulty of philosophers was the low temperature required, especially as hailstorms are most frequent and most severe in hot subtropical regions while in the coldest parts of the world hail is almost unknown. There is, however, no difficulty in finding a sufficiently low temperature if we go high enough into the air, while the frequency of hailstorms in warm latitudes, in summer in the temperate regions and in the daytime compared with the night, is due to their association

with thunderstorms. Thunder clouds, the type which give us hail, may extend to heights of 20,000 feet or more. A great thunder cloud over Exeter was seen from London, a distance of 150 miles, showing that

the summit of the cloud was at least 25,000 feet above the ground. On a hot thundery day temperature decreases upwards at a rate of about 4 degrees Fahrenheit per thousand feet, so that if the temperature near the ground is 80 degrees, the freezing point would be reached at 12,000 feet, and at 25,000 feet the temperature would be below zero.

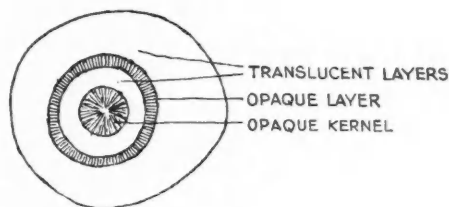


FIG. 1.

### STRUCTURE OF HAILSTONE.

This illustrates the three layers in a large hailstone which fell at Richmond in Yorkshire. (Natural size.)

A hailstone falling at an average speed of 20 miles an hour would take less than seven minutes to fall 12,000 feet, and would have little opportunity to melt by the way, though no doubt small hailstones frequently do melt before they reach the ground.

In the nineteenth century this problem was solved, but it was realized that there were other difficulties, and it is only in the past twenty-five years, largely through the work of Dr. A. Wegener, of Leipzig, that these difficulties have been overcome and a theory of the formation of hail has been developed which is generally accepted in its fundamentals, if not in its details. The hailstone writes its own history in its structure, but the record has not been easy to read. If we cut a large hailstone in half we shall find that it is not a uniform ball of ice, but is made up of two or more skins, somewhat like an onion, except that the skins are less regular than those of an onion and a hailstone cannot easily be "peeled." In the centre is an opaque white kernel, the opaque white or opaline appearance being due to the inclusion of many small bubbles of air, just as the whiteness of snow is due to the air imprisoned in it. Round this kernel is a layer of translucent solid ice with few air bubbles; this layer may extend to the surface, but it is frequently

interrupted by one or more opaque layers similar in structure to the kernel. The outermost layer, however, always consists of translucent ice. The various layers are shown diagrammatically in Fig. 1. The nature of the opaque kernels can be seen more clearly in the soft white pellets of ice known as "soft hail" or "graupel," which in this country fall most frequently in winter, while true hail is more common in summer.

The opaque and translucent parts of a hailstone are both formed by the freezing of water on to a nucleus of ice, the difference in appearance being due to the different rates at which freezing takes place—the more rapid the rate of freezing the whiter and more opaque is the resulting ice. The rate of freezing depends mainly on the temperature of the water immediately before it freezes. It is commonly stated that water freezes at a temperature of  $32^{\circ}\text{F.}$ , but this simple statement is not always true, and it is more accurate to reverse it and say that ice melts at this temperature. If a drop of pure water is maintained in an upward current of clean air, as a pea was maintained above a pipe in an old form of toy, its temperature can be reduced a long way below  $32^{\circ}\text{F.}$  and yet it will remain liquid. It is then said to be "super-cooled."

#### Recent Experiments.

Some experiments described by J. E. Belasco in the *Meteorological Magazine* for May, 1929, illustrate one of the characteristics of super-cooled water. Mr. Belasco employed a "wet-bulb" thermometer, in which a layer of muslin over the bulb of the thermometer is kept moistened with water. He found that when the thermometer was cooled in a refrigerating chamber its reading fell to  $23.7^{\circ}\text{F.}$  without the water freezing. When he touched the muslin with a crystal of hoar-frost, however, the water froze instantly. Similar results were obtained in the open air in Switzerland; whenever the weather was fine the water on the muslin fell to low temperatures without freezing, but when a flake of snow touched the muslin the super-cooled water froze immediately. The actual existence of clouds consisting of drops of super-cooled water was demonstrated in 1850, when two balloonists passed through such a cloud for several thousand feet. Liquid drops did not give place to ice crystals until the temperature had fallen to  $15^{\circ}\text{F.}$  Other observations have shown that cloud particles may remain liquid at temperatures as low as zero Fahrenheit. Thus in a cloud which extends through a sufficient height there are four layers. In the lowest layer, in which the temperature is above  $32^{\circ}\text{F.}$ , the

cloud particles consist of ordinary water above the freezing point. Above this comes a layer in which the temperature is below  $32^{\circ}\text{F.}$  but in which the cloud particles are not yet frozen and consist of super-cooled water. In the third layer freezing has begun and here some of the cloud particles still consist of super-cooled water while others have frozen to form ice-particles. Finally, in the uppermost layer the particles consist entirely of ice. It is in the third layer that the initial stage in the formation of hail takes place; here water and ice exist together, and whenever a drop of super-cooled water touches a particle of ice it freezes instantly. In freezing it expands and imprisons air under considerable pressure, which has actually been measured as nearly four atmospheres.

#### How a Hailstone Grows.

There is, however, another way in which hailstones grow. Consider for a moment what is happening at the surface of a drop of water (not of microscopical size, for that would introduce complications). The molecules composing it are in a constant state of movement, and each second a certain number pass from the surface of the water into the air. In the same time a certain number of molecules of water pass from the air into the water. If the quantity of water vapour in the air is small, more molecules pass from water to air than from air to water; the volume of the drop diminishes and the water evaporates. On the other hand, if for any reason more molecules pass from air to water than from water to air, water condenses on the drop, which grows in size. When this happens the air is super-saturated with respect to the water. If the two numbers are equal, as many molecules passing from air to water as from water to air, the drop neither grows nor diminishes and the air is just saturated.

Suppose now that a number of super-cooled drops of water at a temperature of, say,  $20^{\circ}\text{F.}$  are supported in air which is saturated at that temperature. Now introduce a hailstone at the same temperature. As many molecules per unit area pass from the air to the ice as from the air to the water drop, but fewer molecules leave the ice than leave the water surface. The air is saturated with respect to water but is super-saturated with respect to ice. Hence water vapour condenses from the air on to the ice, which grows in size by the addition of innumerable minute crystals. Actually the process is accelerated because the hailstone, falling from a higher level, is at a lower temperature than the air, and the degree of super-saturation in respect to it may be very great. Thus

the hailstone continues to grow even if no water drops are present, the addition in this case taking the form of an agglomeration of ice crystals which the subsequent addition of super-cooled water binds into opaque white ice.

Outside the kernel of opaque ice we have a layer of translucent ice, resembling that formed when water is frozen in the ordinary way by gradual cooling from above to below the freezing point. This layer is formed in the lower portion of the cloud where the

freezing point is reached only a short distance above the ground, and the lowest part of the cloud may consist of super-cooled water. In these circumstances only opaque ice can form, and so we have chiefly soft hail in winter. Similarly, in India, as noted by Dr. G. C. Simpson, soft hail falls on the hills at Simla because when thunderstorms form over the plains the high ground penetrates into the layer of super-cooled drops.

A vigorous upward current of air is also necessary

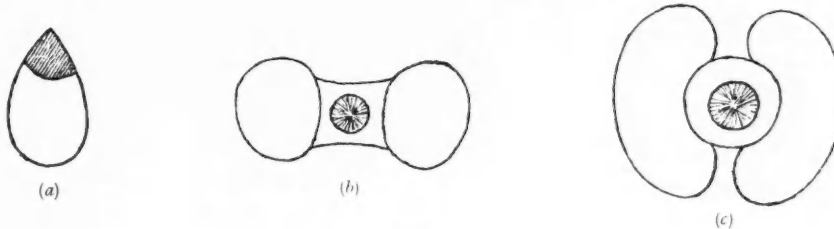


FIG. 2.

## TYPES OF HAILSTONES.

(a) A pear-shaped form the apex of which consists of opaque white ice, the broad base of translucent ice. (b) A rare form consisting of a flat disc with expanded rim. (c) An apple-shaped hailstone due to oscillation of the flat disc type during descent.

temperature of the air is not far from 32° F. Here the hailstone becomes covered with water, which freezes on to it much more slowly than do the super-cooled drops. At first sight it may seem strange that this layer freezes at all, but there are two reasons why it should do so. In the first place the hailstone, having fallen from a higher level, is itself well below 32° F., and so is able to freeze some of the water which surrounds it. The temperature of hailstones lying on the ground after a storm has been measured, and has in some cases been found to be more than 20° F. lower than the temperature of the air. Secondly, though the water drops themselves may not be below 32° F., the air surrounding them may be several degrees colder. It will be seen later that hail is formed in a rapid upward current of air. Rising air expands and consequently cools; the cooling, being mechanical, is immediate. Moist air rising at the rate of 8 metres per second or 18 miles an hour is cooled by 1° F. in about 12 seconds. On the other hand, the cloud particles and water drops which are carried up in the air lose heat only by conduction, a much slower process. Hence we may easily have the condition that while the water drops in the air are at or slightly above a temperature of 32° F., the air and the growing hailstones are below this temperature. This would be a very favourable condition for the liquid water which settles on the hailstones to freeze into a layer of clear ice. In winter, when the temperature of the air is much lower, the

to account for the large hailstones which are sometimes reported. The rate of fall of a hailstone calculated from its size is the rate relative to the air; if it falls at an average rate of 30 miles an hour through air rising at 20 miles an hour, its rate of fall relative to the ground is only 10 miles an hour and it takes three times as long to fall. It may be held up altogether for a time, or even blown back again to higher levels. Hence it can grow to a considerably greater size than if it fell straight to the ground, and in this way there is no difficulty in accounting for even the largest hailstones of which we have *authentic* reports.

The third requirement for the formation of hail is therefore a rapid upward current of air extending to a great height. Such currents are found most often in thunderstorms, and true hail of any great size almost always falls from a thunder-cloud. In fact, the uprush of air necessary to form hail is also necessary, as was shown by Dr. G. C. Simpson, to produce the electricity of lightning. Some upward movement of the air is necessary to form raindrops at all. A raindrop one-tenth of an inch in diameter is just sustained by an upward current of six metres per second, or 13 miles an hour, while a raindrop one-fifth of an inch in diameter is just sustained by an upward current of eight metres per second or 18 miles an hour. Thus if the upward current does not exceed 18 miles an hour the raindrops fall to the ground when they become large enough. A raindrop cannot, however, continue to grow indefinitely in size, as a

hailstone can. When the diameter of the drop exceeds a tenth of an inch it first flattens out and then breaks up into several smaller raindrops, and it is this process of breaking up which provides the electrical energy of the lightning. Thus no rain can fall through an upward current exceeding 18 miles an hour; instead the raindrops are broken up and blown back again to higher levels. Hail, if of sufficient size, is not so limited, and so in some thunderstorms we have the phenomenon of "dry hail," that is, hail not mixed with rain.

The upward current is not necessarily constant in velocity; it may have gusts and lulls like a horizontal wind. A hailstone may be of sufficient size to fall towards the ground during a lull but small enough to be carried up again during the ensuing gust. If during the lull it falls into the level where the temperature of the water drops is about 32° F., a layer of translucent ice will form on it. If then the succeeding gust carries it up again into the level of super-cooled drops, the next layer will be of opaque white ice similar to the kernel. There may be more than one fall and rise, each such event being recorded in the growing hailstone by a layer of translucent ice followed by a layer of opaque ice. The same result would be reached if the upward current was stronger in the centre than at the edges, the hailstone being lifted in the centre and falling back when it escaped from the main current. The outermost layer of all is likely to be formed in the level just above the most violent uprush, where a great quantity of water has accumulated, and here the stone grows most rapidly.

#### The Life Story of a Hailstone.

Having now gathered together all the necessary details, we can at last proceed to write the life story of a hailstone. It begins as a number of scattered molecules of water vapour in moist air near the ground in the path of an advancing thunderstorm. When the air is drawn into the storm it rises, expands and is cooled by expansion until it becomes saturated. The water vapour condenses to form drops, but these are small and are still blown upwards, growing all the time. They pass into air below the freezing point, and rise through a further height of five or ten thousand feet as super-cooled drops, until some of them freeze and form small particles of ice. At this level we have ice particles and super-cooled drops together, and whenever an ice particle touches a super-cooled drop, the latter incontinently freezes on to it. The incipient hailstone so formed, being now too heavy for the air current at that great height to sustain, begins to fall, and on its downward path

it meets and absorbs more of the super-cooled drops which are blown up against it. At the same time ice crystals are being deposited on it direct from the moist air, and by these two processes it gradually becomes coated with a layer of opaque ice.

On its downward path the hailstone meets with warmer and warmer drops, until it enters the level at which their temperature is just about 32° F. Here it becomes coated with water which freezes more slowly and forms clearer ice. From this point the hailstone may continue its journey to the ground, arriving as a simple sphere of moderate size consisting only of an opaque kernel and a single translucent layer, or it may be carried up again into colder levels and begin the process of formation afresh with a layer of opaque ice. Finally, however, it finds a way to the ground, either breaking through the upward current by the mere force of its weight or finding a way round the edge of the current through less disturbed air. It is possible that some hailstones freeze together during the formation of the outermost translucent layer, but it is hardly probable. The freezing together most likely takes place on the ground and accounts for many of the most sensational stories about hailstones, ranging up to the size of a man's head if not larger.

#### A Variety of Forms.

Most hailstones are roughly spherical, but other shapes occur. A pear-shaped form is especially interesting (Fig. 2a); here the apex of the pear consists of opaque white ice and the broad base of translucent ice. This form probably begins with the kernel in the form of a cone with a curved base—a common shape in soft hail—which falls with the base downwards. The apex of the cone holds it steady like a tail, while all additions are made to the base. W. J. Humphreys, however, explains the pear form by the melting of an ordinary spherical hailstone by air flowing past it along stream-lines as it falls through the lowest warm layer of air. On either theory hailstones of this shape would seem to need a rather steady upward current. Another interesting but rare form is shown in Fig. 2b; it consists of a flat disc with an expanded rim. Such discs would tend to maintain a horizontal position as they fell, probably along a zig-zag path, and either because they are rotating about their axis or because of the shape of the stream-lines, they grow most rapidly along the edges. If they oscillate much, the rims would expand still further, giving an apple-shaped hailstone (Fig. 2c), and only a little further extension would be needed to complete the sphere and give a hailstone of the ordinary spherical shape.

It was  
Trini  
the li  
boy  
did t  
with  
missi  
descr  
its ne  
sermo  
volum  
and c  
The  
privat  
provi  
Depa  
their  
of the

The  
Shore  
coast  
news  
party  
men  
Cana  
and  
to es  
chose  
Shek  
to be  
and C  
where  
From  
Labr  
boun  
strip  
them  
part  
amor  
ment  
Saint  
Trav



## Bringing Education to Labrador.

By H. Boswell.

*The mission work which Sir Wilfred Grenfell has undertaken for many years among the fishermen of Labrador is well known. Recently, however, the writer organized a small expedition to establish summer schools for the children and here throws interesting light on the Canadian coasts and their possible development.*

It was Sunday evening in the Cathedral of the Holy Trinity, Quebec. The preacher gave out his text, the lights in the side aisles went down and a small boy near me prepared for repose. Less openly I did the same, but suddenly I found myself listening with growing interest. The preacher was the missionary from the Canadian Labrador, who was describing the bleak coast where the mission is situated, its needs, and especially its needs of education. That sermon led to the organizing of a little band of voluntary teachers, who were to go to the "coast" and carry on summer schools during July and August. The money to finance the expedition was raised by private subscription, the Clarke Steamship Company provided the transport—a big item—and the Quebec Department of Education placed the schools and their equipment, wherever they existed, at the disposal of those responsible for the undertaking.

### Four Schools.

The expedition sailed from Quebec on the "North Shore," the little steamer that links the lonely Labrador coast with the world, and serves as the general store, news bureau, and purchasing agent of the coast. Our party consisted of six members—four teachers (two men and two women), the missionary from the Canadian Labrador, who is also the school inspector, and myself, the secretary-treasurer. Our plan was to establish four schools, for which the settlements chosen were Harrington Harbour, Mutton Bay, Shekatika and Old Fort. The women teachers were to be stationed at the first two, the men at Shekatika and Old Fort, both at the very eastern end of Labrador where the educational problem is most difficult. From Natashquan, our first destination, the Canadian Labrador stretches right down to the Newfoundland boundary, a distance of about 250 miles. Along this strip of coast about 1,500 people are living, many of them descendants of settlers from Jersey. The greater part of the population is scattered in tiny communities among the deep bay and island, the only large settlements besides the four already mentioned being Saint-Augustin, Bonne Esperance (Bony), and Brador. Travelling, in summer fog or storm, is always an

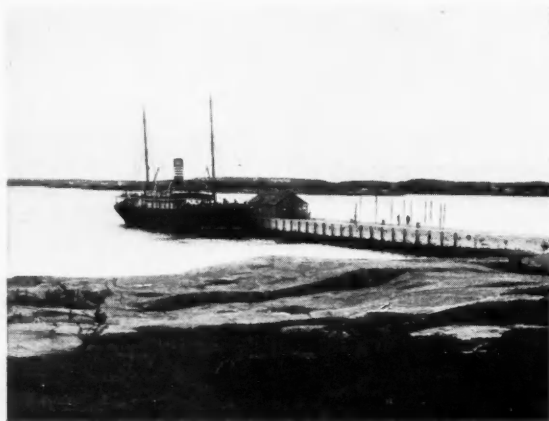
adventure even for the most experienced, especially in the dangerous south-westerly storm which may sweep upon the lonely boat. In winter these same bays are frozen, and from the trackless wastes of snow, haunted by the dread menace of uncertainty, many a komatik and dog-team have never returned.

Remaining some hours at Natashquan, we landed and visited the little Roman Catholic village. The track led through a scrub wood over great slabs of stone and patches of bog, and as we walked back to the boat, we met a little group stumbling along the track, a boy with a lantern leading them. They were a party of American fishermen going to their camp, for the Big Natashquan is a famous salmon river.

When we reached Harrington Harbour where the first of our teachers was to be dropped, the sight that met us was desolate beyond words; driving rain, a wild white capped sea, a distant shore dotted with little houses. The men on deck were hurrying about in waders and oil-skins, and above the gaunt black derrick was swinging a load of cargo into the boats, tossing up and down against the side of the "North Shore." I found the landing party gathered in the smoking-room, and in a few minutes we were told that the shore boat was ready. We made our way along the rain-swept deck to where a rope ladder hung crazily above the wild foaming sea. When the boat cast off it seemed for a moment as if she would be dashed to pieces against the ship's side, but she got off safely and headed for the shore. Harrington Harbour is really the metropolis of the coast. Here are situated the Grenfell hospital, with resident doctor and staff, besides two churches, an Anglican and a Union Church, and a school house.

### Mutton Bay.

Our next destination, Mutton Bay, is the headquarters of the St. Clement's Anglican Mission, which has done so much for Labrador. The little settlement is scattered along the shore, and behind it rises a great range of moss covered headland. In the centre of the settlement, on a high ridge of rocks, stands the little church and school house, and away to the right is the square building of the recently opened nursing



THE NORTH SHORE AT NATASHQUAN.

The ship in which the author's expedition was made is here seen at its first destination on the Labrador coast.

station. Along the water front are clustered the high tressel landing places so characteristic of Labrador, with the "stages" or sheds built beside them where the fish are prepared for drying.

We opened our school the morning after we arrived. The school was a one room building with old-fashioned forms and desks, and in the middle of the room a large stove. The first day had been spent in putting up pictures and maps, with other educative decorations which well-wishing friends had given us, and with intense curiosity we waited for our pupils to arrive. In a community that had been cut off from outside contact for so long, and where there had been such long and close intermarriage, we expected to find children rather undeveloped both physically and mentally. In this we were quite mistaken, for as the children gathered in little groups of twos and threes, we were surprised to find them healthy and good looking. At Mutton Bay and Harrington Harbour schools are held regularly in winter, and the children are fairly well advanced in the three R's. Further east where teaching is much more spasmodic our teachers were faced with unexpected difficulties. They soon discovered that the ordinary groundwork of knowledge which daily life provides to civilized children was frequently missing. In relating the story of Adam and Eve, for instance, the teacher discovered that "serpent" was a word that conveyed nothing—dinosaur, kangaroo, ostrich would have conveyed equally little. The teacher described to me his efforts to find an illustration that would give a realistic impression of Adam and Eve's visitor. "Have you ever seen a garter snake?" he asked. "No." "Ever seen an eel?" "No." The teacher made a last desperate effort and enquired if anyone had ever seen

an earth worm. One proud pupil had enjoyed this experience, and with his help the requisite thrill was imparted to the story.

After seeing this school at Mutton Bay safely opened, I started off with the inspector and his wife in the mission launch, the "Glad Tidings," to visit our schools at Shekatika and Old Fort. Shekatika is about forty-eight miles east of Mutton Bay, and on the trip one passes through the Rigolets, Sandy Island and Long Island Rigolet, two beautiful canal-like reaches of water about twenty-three miles in length. From Harrington Harbour to Old Fort the coast is fringed by a regular archipelago of islands. Between these extends an intricate network of inland passages that constitute the only real throughfare of the coast, but oddly enough these passages are only known to the fishermen along the particular strip of coast off which they lie. In Labrador people always make an early start to benefit by the windless calm of the early morning, but it was evening when we arrived at Shekatika, after it had been raining most of the day. We anchored off a wild strip of shore, where the little house of our teacher squatted against the high rising bank. Below on the strip of beach a couple of boats were drawn up and on the rocks barked half-a-dozen dogs.

To visit the pupils we made a few minutes' walk from the house to a little shack built principally of tar paper and drift wood. Here the five pupils of Shekatika school lived, and here in a bare little room, the air heavy with the smell of drying seal skins, I found the most intense enthusiasm for education. Our teacher had two regular sessions of school for these five children, and also ran an evening class for two older boys who were eager to learn to read. On Sunday his schoolroom, the living room of the house



THE LABRADOR COAST.

The coast off Old Fort, showing the rocky nature of the shore and the rough seas, often navigated only with great difficulty.

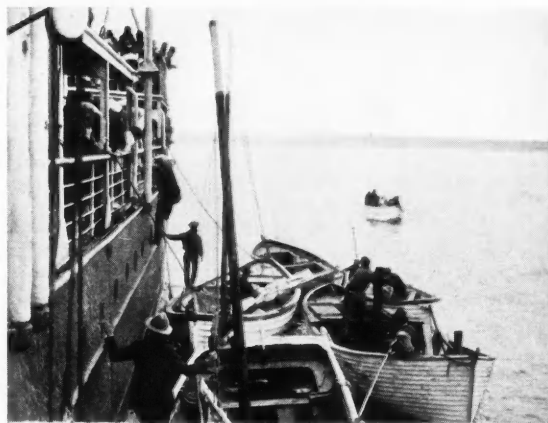
where  
and a  
as the  
the slic  
appeal.  
started  
miles.  
fishing  
The wi  
as in su  
near th  
value d

The  
conditi  
accomm  
pupils,  
to serv  
The ter  
forget  
tiny wh  
of it, a  
on the  
the gre  
we mo  
shore a  
good su  
for as a  
and sa  
those c  
near ou  
consti  
out of  
Two pu  
of the s  
possible  
older cl

Typical w

where he boarded, was turned into a lecture hall and a course of lectures given, but under difficulties as the room was small, the magic lantern smoked, and the slides were too serious to have much popular appeal. We spent the night at Shekatika and then started for Old Fort, a distance of about twenty-two miles. Old Fort is one of the largest of the summer fishing settlements on the whole coast of Labrador. The winter settlements are usually on the mainland, as in summer the people move out to the islands to be near the fishing grounds, every moment being of value during the short fishing season.

The school here was not in a very flourishing condition. It had been impossible to get any accommodation for our teacher, or a building for the pupils, so finally we had to provide a tent which was to serve as a teacher's residence and school combined. The tent was ten by twelve feet in size. I shall never forget my first sight of "Old Fort University"—a tiny white tent with a bare rock rising on one side of it, a great waste of moss and rock stretching away on the other three sides to the coast line, and beyond the grey sea and a wild, yellow sunset. Next day we moved the school to a little plateau nearer the shore and close to a large pool of fresh water. A good supply of water is always important in Labrador for as a rule the settlements are without water systems, and sanitary arrangements are almost as simple as those of the sea-gull. An old bell tent was set up near our own tent, for a schoolroom, the furnishing consisting of a few biscuit boxes and a "globe" made out of a tennis ball with a pencil stuck through it. Two pupils came to the opening class, but by the end of the season the attendance averaged eighteen. The possible school population was twenty-five but the older children had to help with the fish and could not



"ROW FOR THE SHORE."

Boats meeting the *North Shore* near Thunder River, one of the coast stations at which the vessel was halted.

attend. The men at this station were very anxious to have a night class twice a week, and the attendance steadily improved.

What surprised the teachers at all our schools was the keen interest the children took in the cultural side of education. The real accomplishment of the summer schools is not so much the actual teaching, as the interest they arouse in education. On the coast "fish" is the one subject of importance, and it is difficult to make people realize the value of anything else, especially of anything as abstract. The people agree that they would like their children "to have learning," but if it ever comes to a question of learning or fish, the former goes to the wall. This is not to be wondered at, for fish is the great factor influencing life on the coast. It stands for everything real and finally for life itself, but even this simple industry would benefit if the people were better educated.

Labrador is a poor colony, but there is no reason why it should continue so. In addition to the valuable fishing and fur trade, the eider-down industry might also be easily developed. First, however, the general standard of education will have to be raised, and the people brought into closer contact with the outside world and modern trade conditions. In spite of its hardships—or perhaps because of them and their challenge to human life—Labrador has a strange fascination, which holds the inhabitants faithful to its bleak shores. Some few may wander away in search of prosperity but in the end Labrador will surely draw them back to its foggy headlands, to the ceaseless sighing of the waves on the rocks, and to the vast silence of its nights, broken only by the sudden howling of the dogs.



FISHERMAN'S SHACK AT OLD FORT.

Typical wooden dwelling of the Labrador population, which numbers a few thousand fishermen scattered along the rugged coast.

## The Food Fishes of Madeira.

By M. C. Grabham, M.D., LL.D.

*As in other areas the variety of fish alters greatly from time to time in Madeira waters. In describing some of the food fishes of these subtropical deeps the author pleads for a wider interest in research on marine life.*

THE volcanic rocks composing the famous Madeira Archipelago appear to have emerged from the profound oceanic depths in three distinct foci. The main island reaches a height of about 6,000 feet above sea-level; and Porto Santo, fifteen miles to the north, next in area and importance, has one or two peaks 1,500 feet in altitude. The Dezerta line of rocks to the east also rises 1,500 feet from the sea. The component islands and rocks of the group emerge from the water mostly in precipitant rock, with beaches here and there shelving so rapidly into deep water that the hundred-fathom line is reached almost in the space of a stone-throw from the pebbly shore.

### Remote Origins.

The land and sea shells of the district indicate that the rocks were thus inhabited in late Miocene times, but the alternating periods of volcanic activity and slow sub-aerial erosion shown in the precipice faces denote an origin at whose remote antiquity we can only guess. The fascinating scenery into which the islands have been sculptured by the trickling mountain streams, and the native flora with its charm and surprises, confirm other evidence of the long undisturbed quiescence we are now experiencing. But although no sign was shown of recent volcanic action when the Portuguese stumbled upon these islands five hundred years ago, and though no such surface evidence of volcanic activity has occurred during human occupation since mediaeval times, it would be rash to regard the slumbering forces of eruption as finally extinct.

Thirty years ago, whilst engaged in the study of earth currents in a submarine cable, I myself witnessed a violent commotion which destroyed several miles of the submerged cable. This upheaval tore up the oceanic floor to such an extent that for fifteen miles in the neighbourhood of the Dezerta rocks no undisturbed ground could be found for receiving a new electric line when the repairing ship arrived. Such is the environment of the profound oceanic depths which, with its myriad occupants, I ask the reader to explore with me.

In the space at my disposal I can only select a few typical examples of life in these teeming waters.

Three or four members of the Serranus family abound locally, and have their proper depth in the progress of their life-history. One of these, *Serranus Atricauda*, is always found at the sea bottom, a handsome little fish which may be seen in the Madeira tanks at the Zoo, grey or faintly pink and striped with dark-coloured bars. The fish is perennially present, and is much esteemed as a table delicacy. This Serranus, from ten to fifteen inches in length and from one half to two pounds in weight, is taken with a baited line and does not readily enter a trap in the manner of the red mullet. A much larger member of the family, the *Serranus epinephelus*, occurs about the Madeira coast-line at a moderate depth—forty to one hundred and twenty fathoms. This species is sparsely present at all seasons, and is at once distinguished as typical of its tribe, and because of its purple lips is often called *Epinephelus ruber*. The somewhat tough white flesh has an agreeable flavour. I have no knowledge of its breeding or early history, but the species has a food value amply inviting full investigation.

### Dwellers of the Deep.

Predominant in this family is *Polyprion cernier*, an ungainly monster and one of the most important of subtropical food-fishes. This fish breeds on the surface; the eggs are extruded in masses generally protected by a half horny sheath, and often attached to some rocky shelter near the surface. The early life is passed on the surface or a few fathoms beneath. The range of depth increases with growth, and perfectly mature fish with fully developed generative equipment may be found, from twenty to forty pounds in weight, at any depth from thirty to one hundred fathoms.

After this the Sherny descends—slowly perhaps—into the profound cold, dark, abysmal depth, and we see no more of it till it takes our mackerel bait and we haul it up from the sea-bottom when it has acquired a weight of eighty to one hundred and twenty pounds. The passage upwards is fatal to the fish; the air-bladder is torn asunder, the eyes are protruded from their sockets, and the stomach is distended by expanding air and protruded beyond the jaws as a huge bladder. In the last few hundred feet the

monster shoots  
not dead  
content  
2,000 o  
Sherny  
others,  
after ap  
The  
though  
it escap  
is white  
specific  
with an  
life it a  
marine  
British  
In co  
variety  
of the  
elongate  
lives en  
four h  
taken b  
ocean b  
Though  
when fr





CAMARA DE LOBOS, A FISHING VILLAGE IN MADEIRA.

monster rises faster than we can pull him in and shoots out of the water like a cork or an empty bottle, not dead but helpless, lying at our disposal while the contented fishermen estimate his market value. 2,000 or 2,500 feet is no unusual depth whence the Sherny is taken. The heart of this species, as that of others, may be felt and seen beating several hours after apparent death and even dismemberment.

The *Polyprion* has a wide geographical range, though owing to some confusion with the Stone Bass it escaped identity by early ichthyologists. The flesh is white, attractive and popular, though without any specific excellence of flavour. A dull, ungainly fish with an enormous head and prodigious gape, in early life it accompanies floating timber in search of small marine food, and is hence known on the southern British coasts as the Wreck Fish.

In company with the above, the Madeira species or variety of *Prometheus Atlanticus*, the Rabbit Fish of the Portuguese fishermen, has a compressed elongated body thirty inches or more in length and lives entirely at the sea bottom, three hundred to four hundred fathoms below the surface. When taken by an abundantly baited line trailing on the ocean bed it is said to feed with an impatient voracity. Though held in little esteem by the English, the fish when fresh and fried in slices is flaky, rich and not

unpalatable. The *Prometheus* has a formidable dentition, both jaws being furnished with a single row of about twenty-five triangular, short and strong, intermaxillary teeth with sharp cutting edges. There is an ebb and flow in the prevalence of the *Prometheus*, but the food value of the species if adequately explored should be very great. This fish was formerly classified as a Scomber.

The third and last member of the group under consideration is the *Aplurus simplex*, thus known for a century, but which I am now to call *Ruvettus pretiosus*. This is the *Oil Fish* of British ichthyologists, a common object in the Madeira market, attaining a weight of thirty pounds or more. The flesh, which is delicately white but soft and insipid, seems to have been soaked in limpid oil, though this is not rank or strong in taste. If eaten incautiously it acts with an insidious swiftness as an effective evacuant with the inconvenience of little premonitory warning. The fish has no air-bladder, but is capable of rising slowly into moderately shallow water.

The *Polyprion*, *Prometheus* and *Aplurus* live in close association in very deep water. Their mode of life in that stupendous depth and dense pressure, profoundly dark and cold, is truly mysterious. Some of the rich surface Plankton may reach them and assist in sustenance, and their stomachs give ample

evidence of their prey among their kindred and unwary intruders; but their robust development and the plump condition in which they arrive at the surface show that we know little of the food resources of the ocean depths.

### Coloured Fish.

The coloured deep sea fish are not found in the companionship of those we have been considering, neither do they congregate. The local Berycidae, *Beryx splendens* and *B. decadactylus*, furnish gorgeous examples of these and supply our tables with the most attractive of our fish food. In the same family, though less highly coloured, occurs the *Polymyxia nobolis*, the most delicate and desirable of all, but the species is comparatively rare. Nothing is known of its breeding or habits, nor do its numbers affect our market supplies. Of great economic importance and of wider geographical range is the *Scorpaena scrofa*, the great red Scorpion Fish of British waters, whose firm white flesh is in general request. We captured a fine example in stormy weather when I was studying the singular immunity from dental caries enjoyed by the people of Porto Santo, north of Madeira; we grilled the enticing creature over glowing charcoal, and with a sweet potato and a cup of hot "coffee" made of parched barley, I lived for a whole day with ample satisfaction on this excellent food.

Passing from the deep to lighter waters the sea tench, *Physis Mediterraneus*, a southern example of the cod-fish tribe, is an important and unfailing contributor to our fish foods from moderate depths; but without straying further into upper waters, we must observe the *Aphanopus carbo*—the Scabbard Fish—the most prevalent and accessible of refined deep-sea fish-food. The hideous creature never fails us, but abounds and even overflows the unceasing demands which its excellence merits. The *Aphanopus* is one of the Trichiuridae—the Hairtail family, a truly deep-sea fish, though found also at a moderate depth. It appears to breed on the surface, though I have not seen it in the early stages of its growth. It is no uncommon sight to see a thousand or more of the snaky creatures exposed for sale. Eaten fresh, canned for export, or smoked as haddock, it is equally tasty and important.

I have now indicated among hundreds of deep sea fish, many of which are still unidentified, the most prominent types from subtropical deep waters, which will excite interest and which may profitably reward technical observation and economic exploitation or supply the relaxation of sport. I specially suggest the use of deep-sea stationary traps, which may be

raised from time to time with substantial promise of fruitful intake. Nothing of this sort has yet been undertaken, though our pandalus traps sunk to a thousand feet or so give results full of suggestion. The fish abound and give abundant indication of latent resources awaiting exploration. It may be remembered that the discovery of a fishery is believed to have defrayed the total cost of the famous "Challenger" Expedition, and that the accidental capture of a single Tile Fish betrayed the unsuspected haunts of the *Lopholatilus chamaeleonticeps*, and led to a fishery which ministered amply to the needs of the people of the United States over a long stretch of their southern coasts.

Some readers may visit the regions about which I write and take part in the practical solution of the mysteries of deep-sea conditions. The Madeira seas are practically home waters, which may be visited in a sumptuously provided voyage of hardly more than three days' duration from Southampton. The climate is congenial, and free from temperature excesses at any season. The total absence of winter conditions, combined with the entrancing interest of the locality, should draw many to a pursuit of knowledge in a fascinating environment and in the collection of valuable information.

### Faraday Electromagnetic Centenary.

THE arrangements initiated by the Royal Institution for the celebration of the centenary of Faraday's discovery of electromagnetic induction have already been announced; and two committees are now at work. The first of these is concerned with the purely scientific aspects of Faraday's work in relation to the proposed celebrations; the second, representative of organizations in those industries which have risen in the past hundred years upon the scientific foundation of Faraday's discoveries, is dealing with the industrial aspects of the celebrations. Those preliminary discussions which have taken place indicate that the significance of the centenary is very widely appreciated and that the celebrations are likely to arouse world-wide interest and support. The dates have now been fixed, and the proceedings will commence in London on Monday, 21st September, 1931. Further, an intimation has been received from the British Association that their Centenary Meeting will be held in London during the week commencing 23rd September, 1931. These two centenaries, with important electrical conferences and other events which are to take place about the same time, will render 1931 a memorable year in this and every country where the genius of Faraday has borne fruit.

Christi  
W

The P

Mor  
its var  
which  
monum  
filled.  
and pa  
insister  
and of  
of kno  
deman  
Christi  
This

the cap  
to a s  
as Mr.  
Profess  
Murray  
of Yorl  
have c  
Christi  
birth, t  
world  
Bible a  
writing  
the Re  
in the

So gr  
qualitie  
Unity v  
of subje  
whole.  
it is on  
reader.  
through  
a time  
moment  
that th  
to be  
who wi  
but he  
mission  
everybo  
of huma  
the Eas  
the mat  
influenc  
not an  
the rea  
dealing

Part  
world i  
popular  
and mor  
Roman  
It is sai  
early C

## Book Reviews.

*Christianity in the Light of Modern Knowledge.* A Collective Work. (Blackie. 25s.).

*The Pope is King.* By CIVIS ROMANUS. (Benn. 10s. 6d.).

More books have probably been written on Christianity in its various phases than on any other subject or group of subjects which have aroused the interest or curiosity of mankind. Yet monumental as this literature is, there was a gap still to be filled. As each of us comes more and more to know his Bible, and particularly the New Testament, the demand grows more insistent for an historical exposition of the origins of Christianity and of its subsequent developments in the light of the rich store of knowledge which is now accessible to the scholar. This demand has been handsomely met by "The History of Christianity in the Light of Modern Knowledge."

This is, indeed, a remarkable book. It was clearly beyond the capacity of a single author, and the task has been entrusted to a score of contributors including such distinguished men as Mr. Cyril Bailey, Mr. Edwyn Bevan, Professor Burkitt, Professor Garstang, Sir Frederick Kenyon, Professor Gilbert Murray, Professor R. S. Rait, Canon Simpson, the Archbishop of York, Dr. E. W. Watson, and Dr. H. B. Workman. They have collaborated in a book which embraces the history of Christianity and the nature of the Roman Empire which saw its birth, the non-Christian religions and philosophies of the ancient world, including Judaism in which Christ was educated, the Bible as Christ knew it and the rise of the New Testament writings, the early Church and missionaries, mediaeval religion, the Reformation, the English Bible, Dissent, and Christianity in the modern world.

So great an enterprise as this called for the exercise of two qualities above all others—those of unity and concentration. Unity was difficult with so many contributors on such a diversity of subjects, and the book can hardly be read as a consecutive whole. That could scarcely have been avoided and, indeed, it is one of the charms of the volume for the discriminating reader. He need not begin at the beginning and read right through to the end of its 780 pages, but can take a chapter at a time on the branch of the subject which interests him at the moment in any part of the book he pleases, with the reflection that the next evening there is an equally fascinating segment to be enjoyed elsewhere. It is not everybody, for example, who wishes to be instructed in the theology of ancient times, but he may have a passionate interest in St. Paul and his missionary journeys. Again, archaeological records are not everybody's meat, but those who are concerned with the struggles of humanity can turn with satisfaction to the early history of the Eastern Church and the rise of Islam. At the same time the material for a proper understanding of Christianity and its influence on the world is provided in full measure. There is not an additional chapter that could be suggested, although the reader might have wished some sections, notably that dealing with the Crusades, to have been amplified.

Part I of the book is of special importance as it deals with the world into which Christ was born. It corrects a good many popular misapprehensions, as, indeed, does the entire work, and more particularly that of regarding Pontius Pilate and the Roman occupation of Palestine in the worst possible light. It is said with truth that it was an incalculable advantage for early Christianity that it came into being at a time when Judea

was included in a strong, well-disciplined, tolerant, and, on the whole, just Roman Empire. The Life of Jesus is finely told in fifty pages by Professor Burkitt—small compass for so great a story, but nevertheless wonderfully adequate in its place as the kernel of this record. The fascinating story of the New Testament writings and of their preservation is told with the many advantages which the modern scholar enjoys over his predecessors. So the collaborators proceed through their narrative of the world's greatest influence for the next 1900 years—the early Church, the separation between East and West, the mediaeval Holy Roman Empire, and the great clash of the Reformation from which modern history dates.

The later sections of the work, once Luther, Calvin and Knox have been left behind, have inevitably less to inspire than those which have gone before. Still the story of Christian developments in the last three centuries has an abiding interest for the English people. The collaborators do not fall into the error of neglecting the Continent in modern times and laying too much emphasis on British religious movements since the publication of the first English versions of the Bible. The final chapter on Christianity to-day suitably rounds off the whole. The author is the Archbishop of York, and his study of Social and Christian ethics in the modern world is not only well written but highly stimulating. The book contains several useful maps and a number of plates, not all of them on the high level of the text.

The publishers of "The History of Christianity in the Light of Modern Knowledge" point out that the chapter on "Christianity in the 19th Century" was printed before the announcement of the recent negotiations between the Italian Government and the Vatican. Here then was another gap, but in the interval it has been fortunately filled by a shorter volume entitled "The Pope is King." The anonymous Italian author of this book confines his attention strictly to the history of the solution of the Roman question. It is a curious story he has to tell, from the entry of the Italian troops into Rome on 20th September, 1870, until the signing of the various Instruments of Reconciliation by Signor Mussolini and Cardinal Gasparri in the Vatican a few weeks ago. The reader is shown the almost heroic struggle of successive Popes to maintain the principle of Temporal Power, and their vindication, in however limited a form, by the compromise lately achieved. The author has deliberately set his mind against giving any "colour" to the narrative. He has not written a book which is obviously intended for a Roman Catholic audience, and he approaches the history of the Roman question with as unbiassed a mind as is possible on this delicate and fascinating subject. The book, in fact, is a chronicle of one of the most interesting chapters in the history of Modern Christianity. It contains the basic facts and all the relevant documents. The book is well illustrated and contains a clear map of the boundaries of the City of the Vatican.

*The Vampire: His Kith and Kin.* By MONTAGUE SUMMERS. (Kegan Paul. 15s.).

This book is not for the squeamish. The belief in the vampire—the dead who return to suck the blood of the living—is in itself repulsive enough; but Dr. Summers pursues it into all its ramifications and cognates—ghosts who bite, cannibalism, necrophagia, necrophilia, suicide, catalepsy, were wolves, witchcraft, and the like. In exploring these dark places of the human mind, he writes from the strictly orthodox point of view. He is inspired by no morbid curiosity, but from a conviction of the ultimate value of this study in its philosophical and theological implications.

Although the conception of the vampire is familiar, perhaps nowadays, through Bram Stoker's novel "Dracula," the literature relating to it is scanty and for the most part scarce. It does not seem to have received much attention before the seventeenth or eighteenth century. The idea then came from Eastern Europe, and although well known in Greece it was almost certainly Slavonic. Conceptions, if not quite identical, at any rate very closely analogous, can be traced through classical antiquity as far back as Ancient Egypt and Mesopotamia. Geographically they have a world-wide distribution. India and China have both produced beings very closely akin to the European vampire. Dr. Summers, however, is concerned here with the philosophy and general characteristics of vampirism rather than its geographical distribution—a subject which is reserved for treatment in a later volume, together with a more detailed study of recorded cases. For such a task the author is well qualified by his vast and probably unequalled knowledge in detail of the literature of occultism. The book is illustrated by a number of reproductions of appropriately gruesome pictures, including two from the Wiertz Gallery at Brussels.

E. N. FALLAIZE.

*Colour and Colour Theories.* By CHRISTINE LADD-FRANKLIN, Ph.D., Lecturer in Columbia University, U.S.A. (Kegan Paul. 12s. 6d.).

In this collection of articles which have appeared in various American publications Dr. Ladd-Franklin states and restates her evolutionary theory of colour-vision. Young and Helmholtz proved long ago that the three colours red, green and ultramarine-blue, are sufficient to produce, by mixture, all the other spectrum colours. But, as upheld by students of colour from da Vinci down to Hering, there are *four* hues which appear, to the normal eye, as "unitary sensations"—yellow being the fourth. Dr. Ladd-Franklin adds two more—white and black. Now, mixtures of "spectral" red and green form yellow; and mixtures of yellow and violet-blue (or ultramarine) form white. Black, though a colour-sensation, is caused, she states, by absence of any stimulation.

The structure of the retina is more highly developed in its centre, less and less so towards its periphery. In the fibres, cones only are found—no rods. Now, full tetrachromatic vision occurs only in the centre of the retina. And, in the retina of many night-animals, rods only are found. Dr. Ladd-Franklin therefore believes the rods to be the seat of black-and-white vision only; the cones that of chromatic vision. She supposes that a light-sensitive "mother-substance" in the retina is decomposed by light and undergoes partial disassociation. This is different for different parts of the spectrum in the cones, but is alike for all wave-lengths of light in the rods. In the first stage, a *single* cleavage product is split off, the vital response to which is the sensation of white. In the second stage, two cleavage products are given off—one by the long light-waves, the other by the short. The vital responses to these are respectively yellow and blue. In the third stage, the mother substance is capable of giving off three cleavage products; and the three corresponding vital responses are red, green and blue. Though Ramon y Cajal has shown that the cones are more highly developed rods, Dr. Ladd-Franklin thinks that they are probably identical in the embryo. She also thinks that the lower animals, for example, insects, can see only blue and yellow. She affirms that the colours which persist in partial or di-chromatic colour-blindness are blue

and yellow—the red-green end of the spectrum appearing all yellow, the other end all blue.

From all this, the authoress deduces her theory. This is that, in carboniferous times, when vapour-laden skies and phanerogamic vegetation afforded no visible chroma, one light-sensitive substance in the rods, which had not yet become differentiated into cones, responded indifferently to all parts of the spectrum. In more highly-developed animals, as the bees, the cleavage products become capable of responding specifically to the warm and cold ends of the spectrum furnishing, respectively, yellow and blue sensations. This form of vision persists in the partially colour-blind, and in the mid-periphery of the normal eye. A further specialization provides red and green nerve-excitants; but "red-greenness" fuses into the yellowness out of which it was developed. Mr. C. K. Ogden, Editor of the International Library of Scientific Method, writes a preface. The book is illustrated by many diagrams and by beautiful colour-plates; but, to the reviewer, the blue appears too near cyan-blue to correspond to  $470 \mu\mu$ —the complement of yellow; especially as the other two fundamental hues are represented as scarlet and emerald-green; the blue should be a violet-blue (ultramarine).

MARY BARNE.

## Books Received.

- A Brief Course in Biology.* By WELLHOUSE and HENDRICKSON. (Macmillan. 7s. 6d.).
- Reference Book of Inorganic Chemistry.* By LATIMER and HILDEBRAND. (Macmillan. 16s.).
- Laboratory Manual of Comparative Anatomy.* (Macmillan. 10s.).
- Taking the Name of Science in vain.* By H. J. BRIDGES. (Macmillan. 6s.).
- A New School Chemistry.* By F. S. TAYLOR. (Dent. 5s.).
- Heat, Light and Sound.* By P. J. L. SMITH. (Dent. 5s. 6d.).
- Soap Films.* By A. S. G. LAURENCE. (Bell. 12s. 6d.).
- What the World is Made of.* By J. ARTHUR THOMSON. (Newnes. 2s. 6d.).
- Individual Psychological Treatment.* By E. WEXBERG. (C. W. Daniel Co. 6s.).
- Railways of To-day.* By C. J. ALLEN. (Warne. 12s. 6d.).
- The Custom of Cowade.* By WARREN R. DAWSON. (Manchester University Press. 7s. 6d.).
- Introduction to the Study of Bird Behaviour.* By H. E. HOWARD. (Cambridge University Press. 42s.).
- Stephen Hales, D.D., F.R.S.* By A. E. CLARK-KENNEDY. (Cambridge University Press. 15s.).
- Practical Chemistry for Matriculation.* By BRUCE and HARPER. (Macmillan. 2s. 6d.).
- Textbook of Evolution and Genetics.* By LINDSEY. (Macmillan. 12s. 6d.).
- Six Talks on Heredity.* By MARY ADAMS. (Heffer. 2s.).
- The Charm of Surrey.* By GORDON HOME. (Black. 7s. 6d.).
- Experimental Physics.* By CASWELL. (Macmillan. 6s.).
- The Love Story of Adam and Eve.* By A. V. COSHER. (Simpkin Marshall. 3s. 6d.).
- Experience and Nature.* By JOHN DEWEY. (Allen & Unwin. 12s. 6d.).
- Joy in Work.* By HENRI DE MAN. (Allen & Unwin. 8s. 6d.).
- On Liberty.* By J. S. MILL. (Watts. 1s.).
- Short History of the World.* By H. G. WELLS. (Watts. 1s.).
- The Physiological Mechanics of Music Technique.* By OTTO ORTMANN. (Paul. 21s.).
- A Short History of Repton.* By ALEC MACDONALD. (Benn. 12s. 6d.).
- Anthropology in Modern Life.* By FRANZ BOAS. (Allen & Unwin. 10s. 6d.).
- This Bondage.* By COMM. ACWORTH. (John Murray. 7s. 6d.).
- The Rhythms of Life.* By D. F. FRASER-HARRIS. (Routledge. 5s.).



pearing all

y. This is  
skies and  
roma, one  
yet become  
o all parts  
als, as the  
responding  
furnishing,  
n of vision  
l-periphery  
es red and  
s into the  
K. Ogden,  
hod, writes  
ms and by  
lue appears  
omplement  
ul hues are  
lue should

BARNE.

NDRICKSON.

TIMER and

llan. 10s.).

BRIDGES.

t. 5s.).

5s. 6d.).

s. 6d.).

(Newnes.

g. (C. W.

s. 6d.).

Manchester

C. HOWARD.

-KENNEDY.

and HARPER.

(Macmillan.

r. 2s.).

. 7s. 6d.).

6s.).

(Simpkin

& Unwin.

& Unwin.

atts. 1s.).

By OTTO

D. (Benn.

(Allen &

r. 7s. 6d.).

is. (Rout-